International Edition

December 1984 Issue #291
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73®

Amateur Radio's Technical Journal

A CWC/I Publication

Spike Silencer
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More
CoCo SSTV!
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Ham Rows
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BVØAB—84

A Times Square Data Display
Build this scrolling touchtone decoder for your favorite repeater. What you see is what you hear. WA4TEM 8

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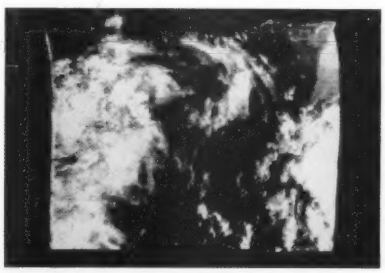

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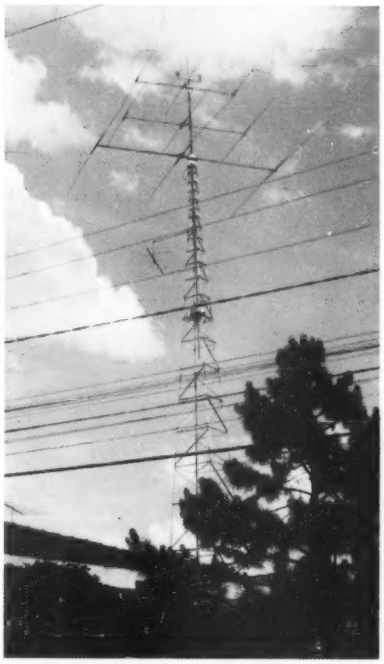
Happy Holidays!



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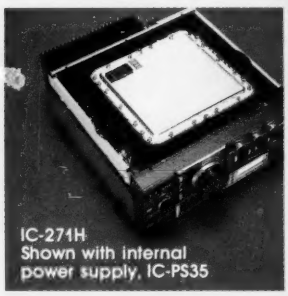

IC-271H
Shown with internal power supply, IC-PS35

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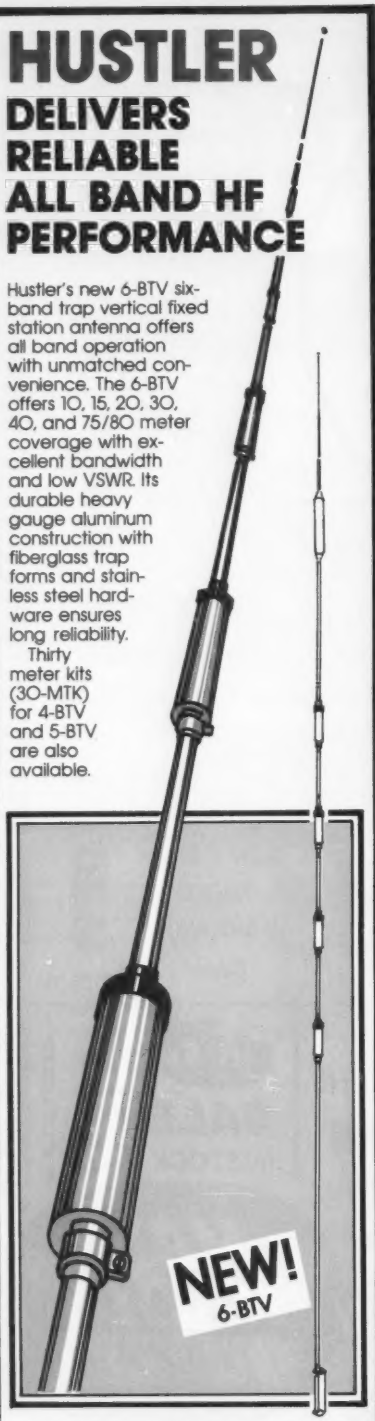

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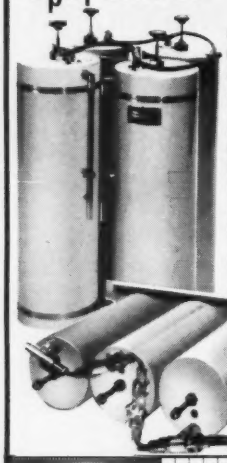

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#8013-S	$499.	$60.	$75.	$125.

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K-7000-AC	550 MHz	5.24288	±1 PPM-RTXO	15 mV −24 DBM	N/A	(2) .1, 1 SEC	10 Hz			100 Hz		No	No	Yes	No
7010-S	1 GHz 600 MHz	10.0 MHz	±1 PPM-TCXO *±0.1 PPM-TCXO	10 mV −27 DBM	20 mV −21 DBM	(3) .1, 1, 10 SEC	10 Hz			10 Hz		Yes	No	Yes	No
8007-S	700 MHz						.1 Hz	1 Hz			10 Hz	Yes	Yes	Yes	Yes
8010-S	1 GHz	10.0 MHz	±1 PPM-TCXO *±0.1 PPM-TCXO *±0.05 PPM-OCXO	10 mV −27 DBM	20 mV −21 DBM	(4) .01, .1, 1, 10 SEC	.1 Hz		1 Hz		10 Hz	Yes	Yes	Yes	Yes
8013-S	1.3 GHz														

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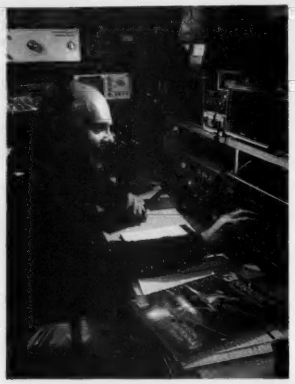

W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

THE FCC—WHERE DO WE REALLY STAND?

If, as they say, good news doesn't sell papers, then this FCC news flash should sell one heck of a lot of magazines. My friends, I do not have any good news for you as far as amateur radio's relations with the FCC are concerned.

I thought things were bad during the Carter administration. For newcomers (and those of you with short memories), the League counsel managed to alienate the entire seven-member Board of Commissioners right at the beginning of their term of office. I've written about that incredible performance too many times to rehash it again.

One result of that was serious talk at the highest levels of the FCC about abolishing amateur radio by combining the CB and ham services. Reagan came along in the nick of time, changing the Commissioners and thus the climate. We got a fresh start.

The previously almost invisible Amateur Radio National Industry Advisory Committee (NIAC) suddenly was promoted to prominence. A new Long-Range Planning Committee made up of top communications executives was set up to plan the development of emergency communications systems which might be viable even in case of atomic attack. Amateur radio was obviously a key element in any plans for emergency communications.

Concerned over the twenty-year lack of significant amateur growth, a factor which has resulted in the average age of amateurs going up into the fifties in just one generation, the Commissioners were anxious to do almost anything which would help get amateur radio growing again.

They viewed amateur radio as an enormously valuable American resource not only for its value for emergency communications, but also as a stepping stone for youngsters into high-tech careers and a source of new communications technologies.

The innovative Japanese used a no-code license to generate over a million new hams in their country, resulting in their graduating seven times as many electronics engineers as America and their taking over almost every consumer electronics industry from us. It seemed reasonable to use their tested and proven method of interesting youngsters in the hobby, so the Commissioners moved ahead with plans to test a no-code amateur license for use on 220 MHz.

They reckoned without the power of the ARRL, which massed the might of their hundreds of clubs to inundate the FCC with protests. The Commissioners not only gave up on the no-code license in disgust, but also they gave up on amateur radio as being of much possible value.

Moves by commercial interests to take over the amateur bands were now being given the nod. You've read about the moves to take the 220-MHz band, right? It looks as if 160 meters will be going away, too—and just when we thought we were going to see the loran stations moved and get the band back just for amateurs.

NIAC was dumped, as was the LRPC, for without amateur-radio growth, hopes of developing any serious emergency communications systems were impossible. The FCC has gotten out of the license testing business. The amateur division of the FCC is virtually extinct. The volunteer program is so screwed up it is a joke, and the Commission could care less.

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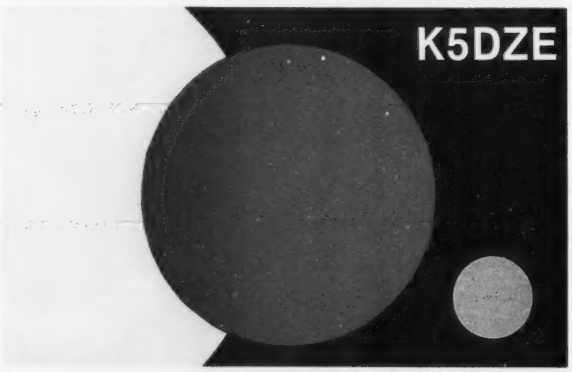

QSL OF THE MONTH

The flag of Earth, symbolizing the Sun, Earth, Moon, and the void of space . . . it is truly the flag of all mankind. K5DZE's card was copyrighted in 1979 by James W. Cadle.

To enter your QSL, mail it in an envelope to *73*, 80 Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

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More information on the TR-7950/7930 is available from authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, CA 90220.

Specifications and prices are subject to change without notice or obligation.

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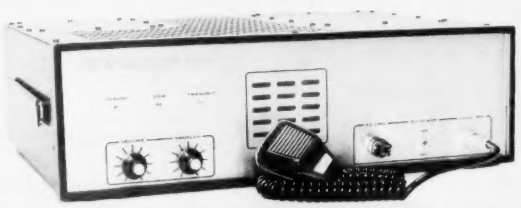

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QRX . . .

EDITED BY PERRY DONHAM KW1O

FCC 3, Hams Won

"I HAVE A SUSPICION that we're not going to lose this band, but that doesn't mean that ham radio is out of the woods," says **Art Reis K9XI.** Art, who is the editor of *220 Notes*, believes that hams have won this battle, although he cautions that further attacks on the 220-MHz spectrum allocation are likely. Incredibly, hams are buying 220 gear by the bushel. Part of the reason is the increasing popularity of digital modes of communication, like packet radio, which use the band for high-speed inter-group linking. The FCC received nearly 300 comments on the issue; most were rational discussions of the impact land-mobile radio would have on 220. This is in contrast to the deluge of unsupported whining the Commission had to wade through during the no-code disaster. According to Art, ". . . the future of 220 MHz is looking up!"

Packet Ears

SPEAKING OF PACKET RADIO, the ARRL is publishing a very informative newsletter for the packeteer, dubbed *Gateway*. It's available to everyone with an interest in the subject, although League members get a discount on the subscription rate. The second issue of *Gateway* described an HF packet bulletin board run by **Hank W0RLI.** Hank's BBS is one of the more popular systems on the east coast and can be accessed on 14.080 MHz using 200-Hz shift at 300 baud. If you would like more information about *Gateway* and packet radio, drop Editor **Jeff Ward K8KA** a note at 225 Main Street, Newington CT 06111. Tell him *73* sent you!

Ducky Wars!

NOW THAT NO-CODE is dead, it's time for a new divide-the-ranks issue: a national 144-MHz repeater standard. Right now we have two. Under the eastern plan, repeaters in the 146–148-MHz subband are spaced 15 kHz apart. The bandplan being used in the western part of the country has them 20 kHz apart. Obviously, this creates real nightmares for repeater coordinators in areas where both systems abut. Who's correct? Rumor has it that Mexico will be using the 20-kHz system (by governmental decree) very soon. Hams in states that border XE-land are going to have mucho problemos when they try to kerchunk their favorite machine—unless they switch their repeaters to 20-kHz spacing. But then what about the hams in states that border the states that border XE-land? You can easily see how the trouble quickly spreads across the nation. It gets really confusing when you realize that the ARRL promotes its own bandplan—repeaters west of the Mississippi are supposed to run inverted. Personally, I think we should implement a national 20-kHz-spacing system. Technically, it makes more sense than what we're doing now. What do you think?

73's Company

DID YOU EVER NOTICE that company is most likely to drop by when the place is a wreck? Well, it happened to us here at *73* a few days ago. It was a fine New Hampshire Friday, and everything we own was in boxes. The furniture was all shoved into one room, and the entire staff was decked out in our finest grubby attire, as we were moving to plush new offices about a mile down the road. Into the middle of this mess stepped **Grant W6NTK,** his family, friends, and two dogs! Grant had driven his RV from California to Maine and wanted to drop in and say hello. We had a very pleasant visit, with Grant demonstrating his allband mobile installation (including RTTY) which was very impressive. Not ten minutes after wishing Grant farewell, we heard a knock on the door . . . it was **Dean WT4A,** who had driven up from Florida! Needless to say, we didn't get a heck of a lot of moving done that afternoon.

Going, Going . . .

WILL HAMS LOSE still more spectrum to commercial interests? The FCC would like to reallocate half of our 160-meter band to non-government radiolocation. Docket 84-874 would move this service to make room for an expansion of the AM broadcast band implemented in the 1979 WARC. Though the amateur community was taken by surprise, the ARRL moved quickly, filing a motion against the NPRM just three days after it was announced.

Author! Author!

FAME AND FORTUNE are what *73* authors receive! We all have a story to tell. Why not tell it to the world? We are looking for articles that deal with the technical side of amateur radio. The how-to-build-it-and-why-does-it-work type of piece that you enjoy reading in *73* every month. It doesn't have to be complete plans for a 9600-baud frequency-agile kilowatt hand-held, just some little gadget that you or a friend have built. I won't tell you how much we pay for articles, but if we really like it, a well-written manuscript could pay for that new packet system you've had your eye on. And don't worry if you can't spell or if your paragraphs are one long sentence. We'll help you over the rough spots. Interested? Send an SASE to *73*, 80 Pine Street, Peterborough NH 03458, Attn: HTW. When your envelope comes back, it will have a copy of our author's guide in it.

Cheap Tricks

YAESU FT-757 OWNERS rejoice! From our something-for-nothing department comes word of a newsletter published by the **757 Club International.** It really looks like a great source of information about this popular rig, and the price is right. Membership in the club, which includes the newsletter, is free—just send a large SASE to 757 Club International, Box 5021-E, Spring Hill FL 33526.

Read This!

WHAT'S NEW WITH YOU? We would like to know just that. You may have noticed (especially if you're reading this) that *73* has a new column. "QRX" is about you—what you are doing, what you've heard, what you would like to do. Don't be shy: Send news items, comments, and what have you to *73* Magazine, 80 Pine Street, Peterborough NH 03458, Attn: QRX Editor. Try to double-space any typed items, and send along a picture if you can.

China Syndrome

WORKED CHINA YET? Neither have I, but there's hope for us little pistols. According to **Tim Chen BV2A/BV2B** in Taipei, exams for ham operators will be given by the Ministry of Telecommunications, and we may expect oodles of BY calls flooding the bands very soon. OK, maybe not flooding, but at least it will be a little easier to get that card you've been wanting. In the meantime, look for BY1PK around 14.155 MHz and between 14.180 and 14.190 MHz at 1400 and 1600 UTC. BY5RA has been heard near 14.195 MHz from 0800 to 1000 UTC.

Fight Back!

THE ARRL HAS FILED a Request for Issuance of Declaratory Ruling with the FCC that asks the Commission to exercise preemptive authority over state and local zoning regulations which affect transmitters and antennas used in the Amateur Radio Service. File formal comments (an original and four copies) with the Secretary, FCC, 1919 M Street NW, Washington DC 20554; refer to PRB-1. The deadline for comments is December 14, 1984.

Robin Rumbolt WA4TEM
1134 Glade Hill Drive
Knoxville TN 37919

A Times Square Data Display

Build this scrolling touchtone decoder for your favorite repeater. What you see is what you hear.

This is a project for repeater operators and people who want to see what they hear on repeaters, namely, touchtones™. It is a Times-Square-style scrolling touchtone data display. It is also a project that I wanted but kept putting off for all of the 12 years that I have been designing and building autopatches and touchtone repeater controllers. I could never justify dedicating a touchtone decoder to a function like this. Touchtone decoders were just too expensive, finicky, or bulky.

Well, things have changed! With its recent introduction of the TRK-956 DTMF (touchtone) decoder kit, Teltone Co. of Kirkland, Washington, will surely put a severe crimp in the 567 tone-decoder business. Priced at only $22.75, the TRK-956 comes complete with an M-956 single-chip DTMF decoder, a 3.58-MHz crystal, and a 22-pin IC socket.

The M-956 decoder is a CMOS chip that includes all filters, decoders, and timing circuits needed to implement a complete 16-digit DTMF decoder. Its block diagram is shown in Fig. 1. The decoder requires only a single +5-volt supply and has a measly current drain of only about 10 mA! By the way, Teltone includes with each kit sold their SC-1 application guide which explains all about telephone lines and signaling standards and has plenty of touchtone applications circuits.

Features

This circuit will display incoming touchtone digits beginning on the right side of the display and scrolling them to the left as new digits are received. The circuit shown in this article is capable of displaying 16 digits.

The circuit has several display-control buttons. A CLEAR button blanks the display and reinitializes memory. The SHIFT button will shift the entire display to the left one place and insert a blank character on the right end. A MATCH button is used for sequence programming (which will be explained later).

A useful feature that I included was that of code matching. A given sequence of numbers ranging in length from 1 to 16 digits may be programmed easily into the unit. Then anytime that exact sequence of numbers is received, the circuit will activate an alarm line. This feature is very handy for several purposes. For example, it can be used to dump an autopatch when an illegal phone number is dialed, or it can be used to set off alarm bells and sirens when a malfunction code is received on a telemetry downlink, or it can be used to unsquelch a station's speaker when an access code is received. I am sure you can think of many other uses.

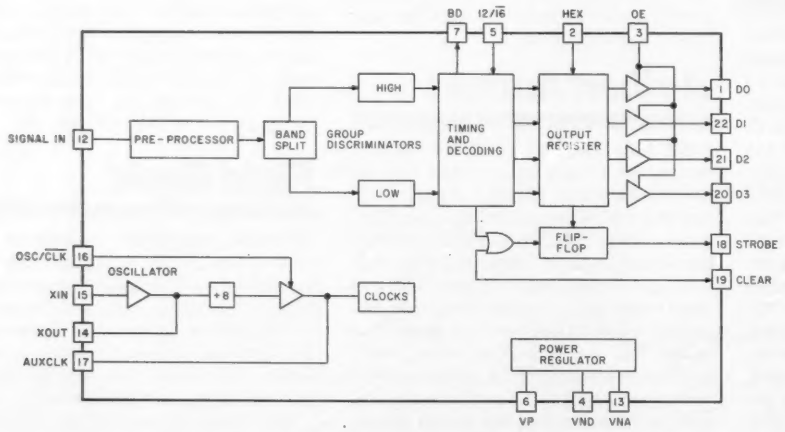


Fig. 1. Block diagram of the M-956.

The Circuit

When I started to design this circuit, I came to realize that a standard shift-register design would require at least 21 integrated circuits. That's a lot more wiring than I wanted to do. Since I am an advocate of the KISS design philosophy (Keep It Simple, Stupid!), I decided to utilize the marvelous power of the microprocessor to simplify. Using the Intel 8748 microprocessor, I

was able to bring the circuit down to just four ICs, which is just about right for two evenings' construction time. The schematic is shown in Fig. 2.

The 8748 microprocessor, or course, controls it all. It receives the binary data from the decoder, transforms the data into 7-segment form, and then routes the proper display data to the segment drivers at the same time that it activates the appropriate digit driver. Every time a new digit is received, the microprocessor checks the currently displayed data to see if it matches a preprogrammed sequence that may have been stored in memory previously. If there is a match, the alarm line is set to a high state. The microprocessor also reads the switch inputs to check for any incoming commands. It does all this many times per second, so quickly in fact that it has no trouble keeping up with the fastest autodialers (about 16 digits per second).

I chose the 8748 for the job because it has all the ROM, RAM, and I/O capability needed on a single chip. I also had one in the junk box! Hi! I realize that not everyone has capabilities for programming EPROM-style microprocessors, so I will offer preprogrammed units at a reasonable price.

In addition to the microprocessor and the tone decoder IC, I used a CD4515 CMOS 4-to-16-line decoder to expand the output capability of the microprocessor. This IC has the capability of driving 16 output lines. These lines then go to discrete transistor digit drivers (Q1–Q12) which supply current to each display digit at the proper time. The microprocessor itself drives the 7-segment driver transistors (Q13–Q19).

Software

Since I am using the same

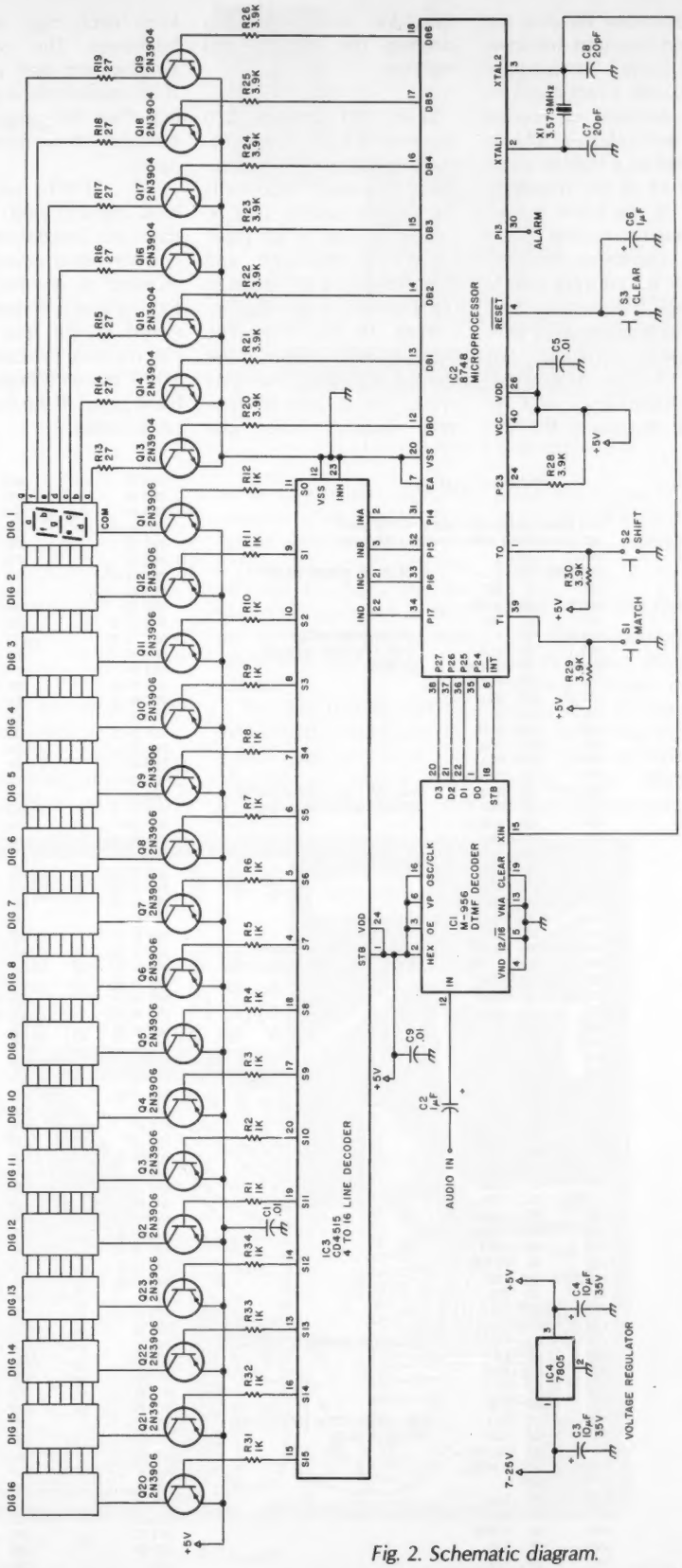


Fig. 2. Schematic diagram.

microprocessor for data display and telemetry transmission, I started the program (below) with a fast check to see if transmit or receive mode was selected. This is indicated by a high or a low on pin 24 of the microprocessor. If the input is low, the transmit routine is selected. Otherwise the program for data display will be executed. The program then initializes registers and memory space. Anytime the CLEAR button is pressed, the microprocessor will reset and re-execute this initialization sequence, thus clearing the display and memory.

Lines 180 through 270 comprise the main loop. Everything else is in subroutines. The main loop calls the display routine, DAGN, checks to see if all digits have been displayed, and then checks the INT input to see if there is a new digit incoming. In this way, new digits are read in only at the end of a display multiplex cycle. This is done to minimize display flicker and keep each digit at equal brightness. The command switches are then checked. If no commands are incoming, then the program just executes the main loop again.

The SHIFT subroutine, lines 280–520, shifts all data down one location in memory when either a new digit is received or the SHIFT button is pressed. A new digit is stored in the now vacant first memory location. If the SHIFT button was pressed, a blank is put in the first memory location.

The digit-display subroutine, DAGN (lines 580–790), pulls the digit to be displayed out of memory, looks up its 7-segment representation in the decode table (lines 1090–1250), and then outputs the digit address and the proper 7-segment code. Since the * and # figures cannot be displayed on a 7-segment display, I replaced them by the "o" and "–" characters, respectively. I also chose to display the sixteenth digit, "D" on most pads, as blank. Imbedded in the DAGN sub-

Program listing.

```
0000                    0010 ***** TOUCHTONE DATA DISPLAY ROUTINE *****
0000                    0020 **** BY ROBIN RUMBOLT  WA4TEH 3/28/83 ****
0000                    0030        ORG  0
0000 15                 0040 START  DIS  I          ; CHECKS FOR TRANSMIT SELECT
0001 0A                 0050        IN   A,P2
0002 53 08              0060        ANL  A,#08H
0004 C6 AD              0070        JZ   XMIT
0006 27                 0080 C1     CLR  A          ; INITIALIZATION ROUTINE
0007 AC                 0090        MOV  R4,A       ;ZEROES & PRE-LOADS REGISTERS
0008 B8 20              0100        MOV  R0,#20H    ;AND PORTS
000A B9 20              0110        MOV  R1,#20H
000C A0                 0120 C2     MOV  @R0,A
000D 18                 0130        INC  R0
000E E9 0C              0140        DJNZ R1,C2
0010 82                 0150        OUTL BUS,A
0011 39                 0160        OUTL P1,A
0012 BB 2F              0170        MOV  R3,#2FH
0014 14 55              0180 STRT   CALL DAGN       ;MAIN LOOP - CALLS DISPLAY ROUTINE
0016 FB                 0190        MOV  A,R3       ;AND READS DECODER AND SWITCHES
0017 03 C1              0200        ADD  A,#0C1H
0019 96 21              0210        JNZ  STRT2
001B B8 2F              0220        MOV  R3,#2FH
001D B6 21              0230        JNI  STRT2
001F 14 27              0240        CALL SHIFT
0021 26 4E              0250 STRT2  JNT0 PSHFT
0023 46 73              0260        JNT1 HOLD
0025 04 14              0270        JMP  STRT
0027 B8 3E              0280 SHIFT  MOV  R0,#3EH    ;THIS ROUTINE READS THE DECODER
0029 B9 3F              0290        MOV  R1,#3FH    ;AND SHIFTS ALL DIGITS LEFT ONE PLACE
002B BA 0F              0300        MOV  R2,#0FH
002D F0                 0310 LJI    MOV  A,@R0
002E A1                 0320        MOV  @R1,A
002F C8                 0330        DEC  R0
0030 C9                 0340        DEC  R1
0031 EA 2D              0350        DJNZ R2,LJI
0033 27                 0360        CLR  A
0034 76 38              0370        JF1  SI
0036 1C                 0380        INC  R4
0037 0A                 0390        IN   A,P2
0038 53 F0              0400        ANL  A,#0F0H
003A 47                 0410        SWAP A
003B A1                 0420 SI     MOV  @R1,A
003C B6 93              0430        JF0  CHECK
003E 14 55              0440 KGO    CALL DAGN
0040 FB                 0450        MOV  A,R3
0041 03 C1              0460        ADD  A,#0C1H
0043 96 47              0470        JNZ  STRT3
0045 B8 2F              0480        MOV  R3,#2FH
0047 26 3E              0490 STRT3  JNT0 KGO
0049 B6 4D              0500        JNI  ERE
004B 04 3E              0510        JMP  KGO
004D 93                 0520 ERE    RETR
004E A5                 0530 PSHFT  CLR  F1          ;THIS ROUTINE RESPONDS TO SHIFT BUTTON
004F B5                 0540        CPL  F1
0050 14 27              0550        CALL SHIFT
0052 A5                 0560        CLR  F1
0053 04 14              0570        JMP  STRT
0055 1B                 0580 DAGN   INC  R3          ; MULTIPLEXES DISPLAY ONE DIGIT EACH
0056 FB                 0590        MOV  A,R3       ;TIME IT IS CALLED
0057 98 00              0591        ANL  BUS,#00H
0059 53 0F              0600        ANL  A,#0FH
005B 47                 0610        SWAP A
005C AE                 0620        MOV  R6,A
005D 09                 0630        IN   A,P1
005E 53 0F              0640        ANL  A,#0FH
0060 4E                 0650        ORL  A,R6
0061 39                 0660        OUTL P1,A
0062 FB                 0670        MOV  A,R3
0063 A8                 0680        MOV  R0,A
0064 F0                 0690        MOV  A,@R0
0065 03 F0              0700        ADD  A,#0F0H
0067 A3                 0710        MOVP A,@A
0068 82                 0720        OUTL BUS,A
0069 23 F9              0730 OUT1   MOV  A,#0F9H
006B 62                 0740        MOV  T,A
006C 55                 0750        STRT T
006D 16 71              0760 IN     JTF  OUT2
006F 04 6D              0770        JMP  IN
0071 65                 0780 OUT2   STOP T
0072 93                 0790        RETR
0073 B8 20              0800 HOLD   MOV  R0,#20H    ;FREEZES NUMBER INTO MEMORY WHEN
0075 B9 30              0810        MOV  R1,#30H    ;MATCH BUTTON IS PRESSED
0077 FC                 0820        MOV  A,R4
0078 C6 91              0830        JZ   FINIS
007A AF                 0840        MOV  R7,A
007B AD                 0850        MOV  R5,A
007C F1                 0860 LOOP   MOV  A,@R1
007D A0                 0870        MOV  @R0,A
007E 19                 0880        INC  R1
007F 18                 0890        INC  R0
0080 ED 7C              0900        DJNZ R5,LOOP
0082 B5                 0910 WT     CLR  F0
0083 95                 0920        CPL  F0
0084 56 91              0930        JT1  FINIS
0086 14 55              0940        CALL DAGN
0088 FB                 0950        MOV  A,R3
0089 03 C1              0960        ADD  A,#0C1H
008B 96 82              0970        JNZ  WT
008D B8 2F              0980        MOV  R3,#2FH
008F 04 82              0990        JMP  WT
0091 04 14              1000 FINIS  JMP  STRT
0093 B8 20              1010 CHECK  MOV  R0,#20H    ;CHECKS CURRENTLY DISPLAYED NUMBER
0095 B9 30              1020        MOV  R1,#30H    ;AGAINST NUMBER IN MEMORY. SETS
0097 FF                 1030        MOV  A,R7       ;ALARM BIT WHEN MATCH IS FOUND.
0098 C6 A9              1040        JZ   EXIT
009A AD                 1050        MOV  R5,A
009B F1                 1060 LOOP2  MOV  A,@R1
009C 37                 1070        CPL  A
009D 17                 1080        INC  A
009E 60                 1090        ADD  A,@R0
009F 96 A9              1100        JNZ  EXIT
00A1 18                 1110        INC  R0
00A2 19                 1120        INC  R1
00A3 ED 9B              1130        DJNZ R5,LOOP2
00A5 89 08              1140        ORL  P1,#08H
00A7 04 3E              1150        JMP  KGO
00A9 99 F0              1160 EXIT   ANL  P1,#0F0H
00AB 04 3E              1170        JMP  KGO
00AD 24 00              1180 XMIT   JMP  0100H
00AF                    1190        ORG  0F0H       ;HEX TO 7 SEG. DECODE TABLE
00F0 00                 1200        DB   00H        ;"D" DISPLAYED AS A BLANK
00F1 06                 1210        DB   06H        ;"1"
00F2 5B                 1220        DB   5BH        ;"2"
00F3 4F                 1230        DB   4FH        ;"3"
00F4 66                 1240        DB   66H        ;"4"
00F5 6D                 1250        DB   6DH        ;"5"
00F6 7D                 1260        DB   7DH        ;"6"
00F7 07                 1270        DB   07H        ;"7"
00F8 7F                 1280        DB   7FH        ;"8"
00F9 6F                 1290        DB   6FH        ;"9"
00FA 3F                 1300        DB   3FH        ;"0"
00FB 5C                 1310        DB   5CH        ;"*" DISPLAYED AS SMALL "O"
00FC 40                 1320        DB   40H        ;"0" DISPLAYED AS "-"
00FD 77                 1330        DB   77H        ;"A"
00FE 7C                 1340        DB   7CH        ;"B"
00FF 39                 1350        DB   39H        ;"C"
0100                    1351 *
```

Program Memory

000–013 Initialization routine
014–026 Main loop routine
027–04D SHIFT subroutine
04E–054 Button shift routine
055–072 DISPLAY DIGIT subroutine
073–091 HOLD subroutine
092–0AC CHECK subroutine
0AD–0AE XMIT VECTOR
0AF–0EF Unused
0F0–0FF Seven-segment decode table
100–3FF Unused

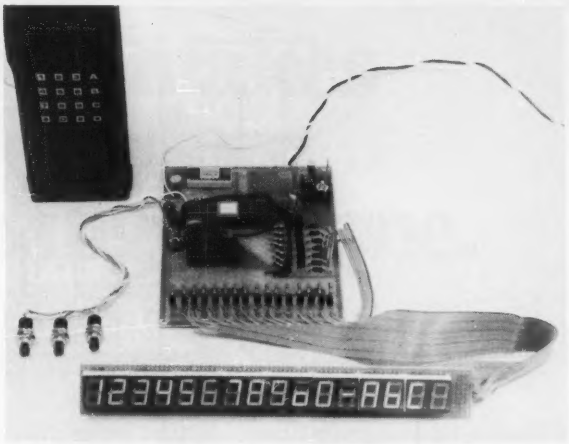
Data Memory

00–07 Register Bank 0 (R0–R7)
08–17 Stack
18–1F Register Bank 1 (Unused)
20–2F MATCH sequence storage
30–3F Display digit storage

Register Usage

R0 = General use
R1 = General use
R2 = Loop counter
R3 = Display memory address pointer
R4 = Sequence length counter
R5 = Loop counter
R6 = General use
R7 = MATCH sequence length storage

Fig. 3. Memory-usage chart.



The touchtone data display.

routine is a small delay routine, lines 730–780, which is used to slow down the multiplex rate. Too fast a rate limits digit brightness, while too slow a rate would cause noticeable flicker.

The HOLD subroutine, lines 800–1000, moves whatever numbers are currently on the display into sequence memory when the MATCH button is pressed. It also sets a flag, F0, which tells the program to check the display digits against this memory for a sequence match anytime a new digit is received.

The last routine, CHECK (lines 1010–1180), does the actual comparison of display data and memory data. If a match is found, the alarm bit is set. Otherwise the alarm bit is cleared. Fig. 3 shows a memory-usage chart.

Construction and Operation

A printed circuit board was developed for this circuit and is shown in Fig. 4. Fig. 5 shows the parts placement. Note that the circuit board does not include the display LEDs themselves. Because of the wide variety

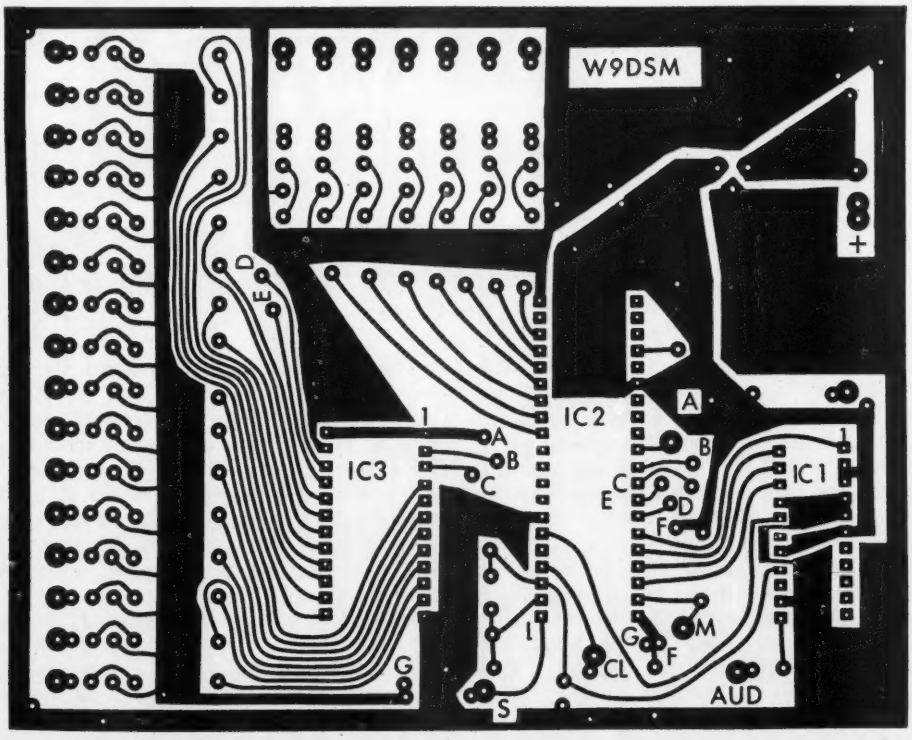


Fig. 4. PC board.

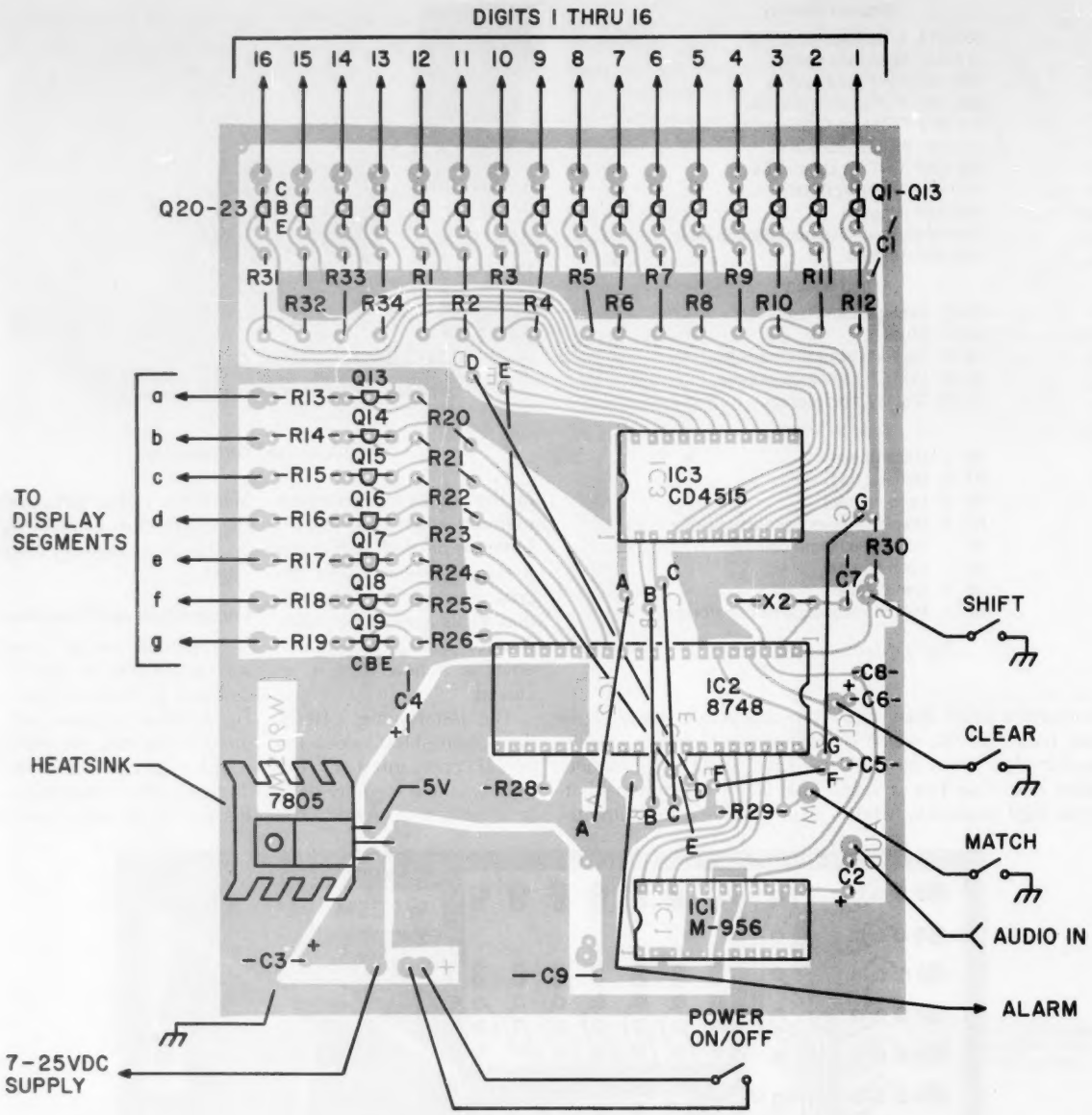


Fig. 5. Parts placement.

of LED displays that may be used in this circuit, I decided not to design a PC board for them. Any common-anode LED display may be used. If you decide to use the popular multi-digit stick-type displays, make sure that they are the multiplex type and not the direct-drive type. Whatever display you choose, wire all segment lines in parallel and bring out all anode lines separately. Your display may be any length you choose up to 16 digits. I limited my first prototype to only 12 digits. Simply leave out any digit drivers at the left side of the display that are unused.

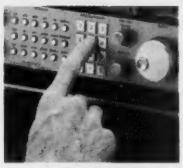
The 5-volt regulator chip, IC4, can get quite warm during operation since the circuit draws about 250 mA. Because of this, a heat sink should be included. The PC board layout includes space for a TO-220-style heat sink.

There are seven jumpers, labeled A–G, which should be installed on the board *after* all other components are in place.

Initial power-up should be preceded by a voltage check with IC4 in place and IC1, IC2, and IC3 removed from their sockets. Check the power pins for proper voltages. These ICs are getting less expensive but still are not cheap enough to blow because of a wiring error or solder bridge!

Once the voltage check has been successfully completed, disconnect power and install all ICs in their sockets. Note that IC2 points the opposite direction of IC1 and IC3. Apply power. If all is well, the display should come up blank. Feed a source of touchtone audio to the decoder. The decoder requires an audio voltage in the range of about 150 mV to 2 V p-p. As each digit is received, it should be displayed at the right end of the display. Successive digits will cause previously received digits to be shifted one place to the left.

Pressing the SHIFT button also will cause digits to shift



The DX 1000 makes tuning in London as easy as dialing a phone.

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Parts List

Quantity	Designation	Description	Cost
16	R1–R12, R31–R34	Resistor, 1k Ohm, ¼ W, 5%	$ .96
7	R13–R19	Resistor, 27 Ohms, ¼ W, 5%	.42
10	R20–R26, R28–R30	Resistor, 3.9k Ohms, ¼ W, 5%	.60
2	C7, C8	Capacitor, 22 pF, 50 V disc ceramic	.16
3	C1, C5, C9	Capacitor, .01 μF, 50 V disc ceramic	.24
2	C2, C6	Capacitor, 1 μF, 16 V electrolytic	.34
2	C3, C4	Capacitor 10 μF, 25 V electrolytic	.36
16	Q1–Q12, Q20–Q23	Transistor, PNP 2N3906 or equivalent	4.00
7	Q14–Q19	Transistor, NPN 2N3904 or equivalent	1.75
1	IC1	TRK-956 DTMF decoder kit	22.75
1	IC2	8748 microprocessor (see text)	50.00
1	IC3	CD4515 CMOS decoder	2.49
1	IC4	LM7805 5-volt regulator	1.59
16	DIG1–DIG16	LED, 7-segment common anode display	16.00
1	—	40-pin IC socket	.49
1	—	24-pin IC socket	.33
1	—	PC board	10.00
1	—	Heat sink, T-220 style	.25

NOTE: The crystal, X1, and 22-pin socket are included in the TRK-956 kit available from Teltone Corp., PO Box 657, 10801 120th Ave. NE, Kirkland WA 98033-0657; (206)-827-9626.

left, but instead of a new digit appearing, a blank will be inserted at the right end. This SHIFT button is very handy to insert blanks between incoming digits. It may also be used, when held down, to temporarily freeze what is on the display.

To program the unit to recognize a specific code, first press the CLEAR button to clear the display and memory. Then enter in the code that you want recognized. Do not enter any additional digits or blanks that you do not wish included in the sequence. Then press the MATCH button. From now on, any time that that exact code is received, the alarm line will be activated. Each time the code is recognized, the alarm line will stay activated only for as long as no additional digits are received. The matching process will be deactivated and memory purged when the CLEAR button is pressed.

Conclusion

I wish to thank Paul Hamilton WD4MQQ for his excellent photographic assistance and his PC board expertise. I also wish to thank Bill Kaylor W9DSM for developing the PC board layout and also for his nagging, which made me finally build this thing.

As I mentioned previously, I will make available preprogrammed and tested 8748 microprocessors for $50.00. Printed circuit boards are $10.00 each. ■

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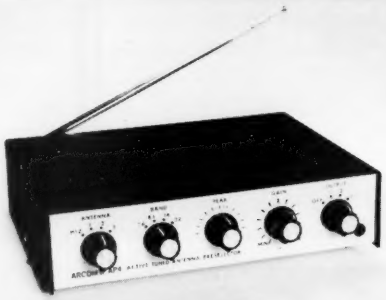

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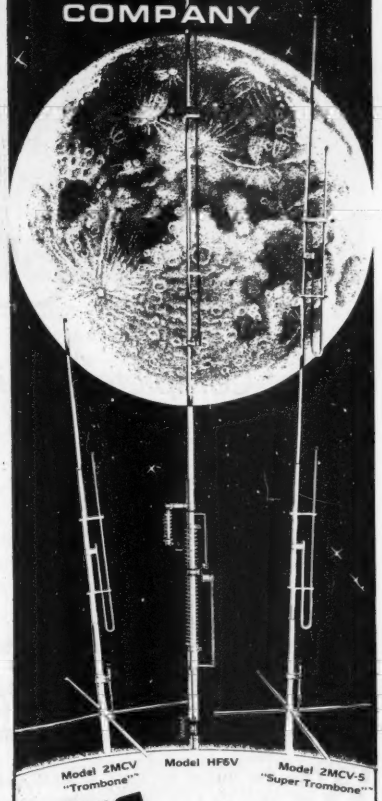

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Color Computer SSTV: Part II

Complete the picture by adding weather-satellite facsimile to your new color SSTV system.

Editor's note: Part I of this article, detailing a complete color SSTV interface, appeared in the November, 1984, issue of 73.

Clayton W. Abrams K6AEP
1758 Comstock Lane
San Jose CA 95124

Dr. Ralph Taggart WB8DQT
602 Jefferson
Mason MI 48854

With the initial success of the K6AEP interface, SSTV software, and high-resolution display board, the next "new" application considered was facsimile. HF FAX operation has never had much of a following among amateurs but there is one area where amateur FAX techniques are booming—weather satellites.

Thousands of amateurs and non-amateurs alike track the many different kinds of weather satellites now in orbit, and what has been needed for years is a nice, simple, and versatile display system that would

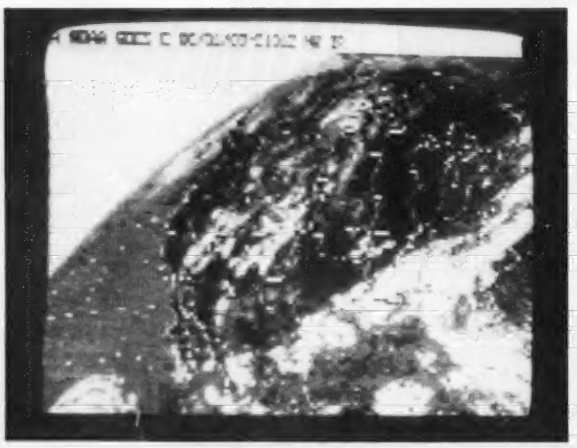

Photo A. An infrared (IR) view of the NW quadrant of the earth as transmitted by the GOES E spacecraft using the WEFAX imaging format. A major frontal system can be seen wrapping around from the Gulf Coast up into New England. Broken frontal activity can also be seen in the Rockies and Plains states. Although some of the gridding of state borders and other features can be resolved, one of the higher-resolution formats (see photos) would be required to capture all the details in a picture of this type.

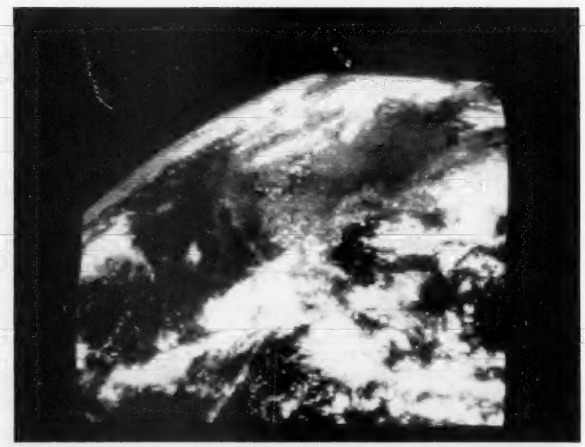

Photo B. Full-frame display of the NW quadrant of the earth as seen by GOES E in visible light. This image covers the same area as Photo A but visible-light imagery is rarely gridded. Even with the full-frame display the resolution achieved exceeds that of some small CRT display systems and is entirely adequate for most uses.

handle pictures from all of them! K6AEP was certain that the SSTV software could be modified for FAX display, and WB8DQT was equally certain that a multimode satellite interface could be designed to take advantage of the CoCo® as an image processor and display system.

With the two of us madly experimenting in our areas of expertise, we soon had a workable system up and running, and the results exceeded all of our expectations! With the satellite interface to be described this month (and with the high-resolution display board described in Part I) you can be scan-converting all types of US and Soviet weather-satellite pictures in no time at all! The mix of features available with the current software is mind-boggling compared to conventional techniques! Some of these features include:

- Full-frame display of imagery from all current operational satellites. These include both geostationary (US GOES, European METEOSAT, and Japanese GMS) and polar-orbiting spacecraft (US TIROS/NOAA and Soviet METEOR).

- The ability to capture extremely-high-resolution subsets of any images that exceed the theoretical resolving power of the image format.

- Computerized "zooms" on any portion of the image in memory.

- The ability to rotate images by 180 degrees, thus eliminating the upside-down pictures characteristic of south-to-north polar-orbiting passes.

- The capacity to enhance the contrast of the satellite picture—a real boon in the case of infrared polar-orbit imagery.

- Two different kinds of false-color display.

- The ability to generate hard copy using a graphics printer.

This is a mix of features you cannot find in any available display system, but there is even more! If you combine the SSTV interface (Part I) with the satellite interface to be described here, you obtain the following additional features:

- Complete HF FAX display capability for wirephotos and weather charts.

- The ability to record or transmit weather-satellite pictures in standard SSTV formats.

All of this may seem like quite a tall order but we can deliver—as we hope to demonstrate here. Let's get fired up and see how it's done!

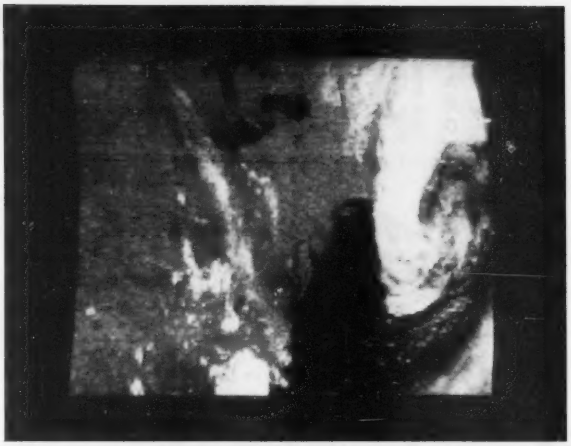

Photo C. A NOAA 7 visible-light APT pass showing the east coast. Delaware, New Jersey, and Long Island show quite clearly in this full-frame display but much of New England is buried under a major cyclonic storm system in the process of moving out to sea. Lake Erie and Lake Ontario are visible at the top center of the display.

The Satellites

The one thing we do not have the space for is a description of the various satellite systems and image products. Your best source of information in that area is the *New Weather Satellite Handbook*, available at your local library (out of print). This publication provides all of the information on the satellites, their video formats, tracking and antenna alignment, construction of receivers, antennas, test equipment, and a full range of construction projects for FAX and CRT image display. If you are into satellites, you probably have the book already and can move directly to the CoCo scan-converter project. If you are new to the game, you had better find a copy so that you are ready to go when your hardware is on-line.

The Weather-Satellite Interface

At this point we will deal with how to condition and process the satellite signal for proper input to the CoCo. Satellite mode is relatively unimportant in the discussion which follows. Simply keep in mind that we are dealing with an amplitude-modulated 2400-Hz tone (black = minimum and white = maximum) with line rates of either 120 or 240 lpm (equivalent to either 2 or 4 Hz).

Each of the circuit descriptions to follow has several sections. The *Function* description tells what the circuit does; the *Operation* section describes how it works; the *Construction* section will describe any specifics that need be observed in laying out or wiring the circuit; the *Adjustment* section tells how to set up that part of the system. Actual operation of the complete interface will be described under "System Operation."

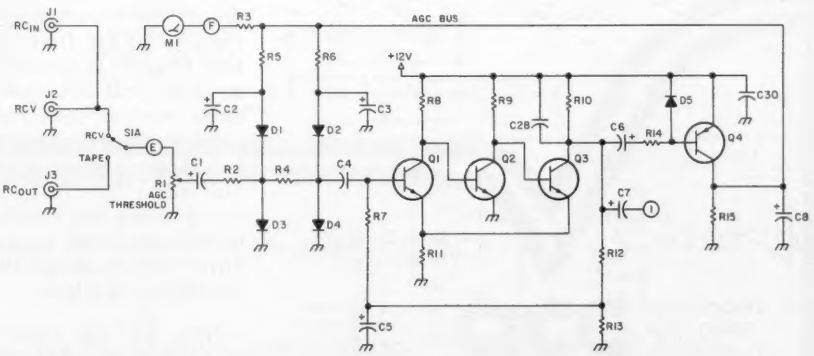

Fig. 1. Automatic gain control.

Main-Board Pinouts

Schematic Designation	I/O Function
A	Ground
B	+5 V (If regulator off board)
C	+12 V
D	−12 V
E	Video in from S1A
F	Agc meter
G	Contrast control
H	Contrast control
I	Video out to J7
J	Clock out to J4
K	Clock out to S1B
L	To Phase switch
M	To 120/240 lpm switch
N	Sync out to J6
O	To Reset switch

Front-Panel Controls and Indicators

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120/240 lpm switch
Phase switch
Reset switch
Agc meter
Contrast control
RCV/Tape switch

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RCV	From station receiver
RC Out	Right-channel tape output
RC In	Right-channel tape input
LC Out	Left-channel tape output
LC In	Left-channel tape input
Sync	To CoCo serial port
Video	CoCo right joystick port

Main-Board Controls and Indicators

Agc threshold	R1
Black level	R31
Clock freq.	C17
Vco lock	R42
Sync lock	D9 Indicator

Table 1. Packaging data.

One final note. It is assumed that the interface will be wired on a plug-in prototype card or on a PC board available from one of several vendors. The pinout designations in the following descriptions are arbitrary and the actual pinouts on your board will have to be related to these designations. Table 1 is provided to summarize the pinout designations used in the descriptions to follow. This information can be related to your board documentation or consulted as you work up your own layout. A list of vendors known to be supplying boards, kits, and wired-and-tested units is included in Part I of this article.

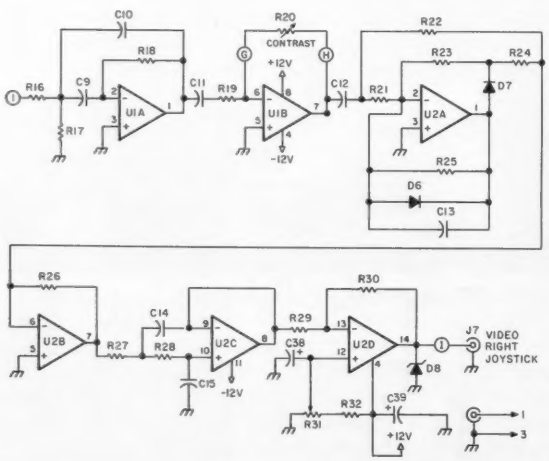

Fig. 2. Video circuits.

Automatic Gain Control (See Fig. 1)

Function. Since weather-satellite video involves amplitude modulation of an audio tone, the various video circuits are sensitive to peak subcarrier levels. With multiple satellite video sources, different receivers, tape systems, etc., constant readjustment of video-input levels would be required to maintain an acceptable gray-scale range. The automatic-gain-control (agc) circuits process signals of varying levels, delivering a signal of constant peak amplitude to the rest of the video processing circuits. Thus the video system functions with minimal adjustment over a wide range of input levels.

Operation. Video from the receiver is routed to J2 (Receiver) with J1 (RC In) in parallel to provide the capability to simultaneously display and record receiver signals. Video from the tape recorder is connected to J3 (RC Out). Selection of either receiver or recorder video is by means of the RCV/Tape switch (S1A). The video line from the switch enters the interface board at pin E with the Agc-Threshold control (R1) functioning as a load.

From R1, the signal is routed through a two-stage diode network (D1–D4) which provides attenuation as a linear function of the control voltage on the agc bus. From the attenuator, the signal is routed through a three-stage agc amplifier (Q1–Q3) with a fixed voltage gain of 100. Normally the output of this amplifier is about 2 V p-p. The amplifier drives the agc detector (Q4) which develops the agc control voltage on its collector. The attack time constant of the detector is a function of C6 and R14 while the decay time constant is determined by C8, R15, and the series resistance of R3 and the 50-microamp agc meter (M1).

If the peak input signal should increase, the agc bus voltage will rise, increasing the attenuation in the diode network and lowering the output of the agc amplifier to its previous value. Similarly, should input peak level decrease, the agc bus voltage will drop, decreasing input attenuation and raising the output of the agc amplifier. The output of the agc amplifier chain, maintained at a relatively constant peak level, drives the remaining video circuits at point (1). The agc meter serves to indicate the agc control voltage and is used to ensure that input signals produce control voltages in the most linear portion of the agc response curve (1–2 V).

Construction. Note that Q4 is a PNP transistor and must be installed with its emitter on the 12-V bus. Also note the polarity of C6 which is oriented differently from all of the other tantalum coupling capacitors.

Adjustment. For best results, the output from the receiver should be tapped at the top of the volume control through a .1-μF coupling capacitor to provide a constant output level that is independent of the receiver volume-con-

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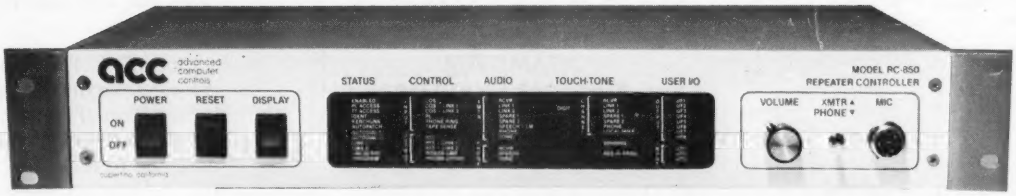

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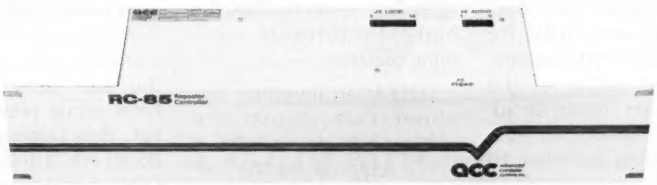

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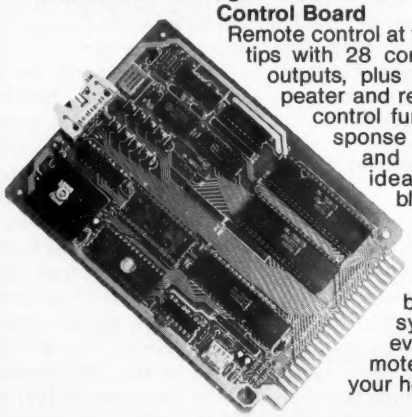

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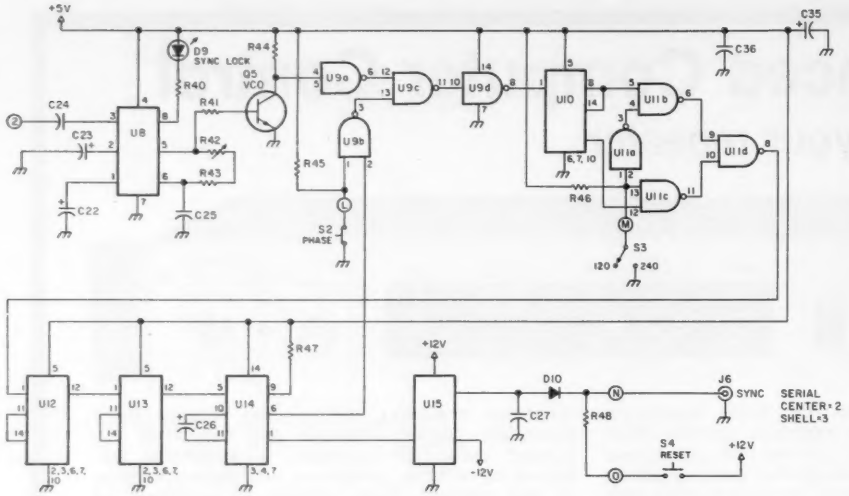


Fig. 3. Line synchronization.

trol setting. With noise output from a vacant satellite channel, adjust the Agc-Threshold control (R1) for an agc-meter (M1) reading of 15. The output of the tape recorder should be adjusted to produce an agc-meter reading between 10 and 20.

Video Circuits
(See Fig. 2)

Function. The video circuits provide subcarrier filtering, detection, post-detection filtering, and gain adjustments to properly drive the joystick (A/D) input.

Operation. Video from the agc amplifier (point 1) is routed through an active bandpass filter (U1A) with a center frequency of 2400 Hz, a bandwidth of 1600 Hz, and unity gain. The filtered output drives a variable gain stage (U1B) with gain set by the front-panel Contrast control (R20).

U2A and U2B comprise a precision full-wave detector that generates a negative-going signal containing the modulation envelope superimposed on the post-detection 4800-Hz subcarrier component. U2C is an active low-pass filter with a nominal cutoff frequency slightly above 500 Hz. The roll-off characteristics of this filter ensure optimum resolution in the highest-resolution sampling modes.

U2D is an inverting amplifier that adjusts the video signal to the 0–5-V range required for the joystick A/D input. The offset is adjustable (R31) to set the desired black level while the Contrast control provides the drive adjustment that determines the maximum white level. D8 provides white-level clipping at 5.1 V. The detected waveform is routed off the main board at pin 1 and on to J7 (Video) on the rear apron. The center conductor of the mating jack for J7 is connected to pin 1 of the joystick plug while the shell (ground) is connected to pin 3 of the joystick plug.

Construction. The front-panel Contrast control should be wired so that minimum resistance corresponds to maximum CCW rotation of the control shaft. The joystick plug can be a hard item to obtain. The easiest approach is to disassemble a standard CoCo game joystick, since you get the plug with cable attached. The phono plug to J7 should be wired with the yellow lead to the center pin and the black wire to the shell.

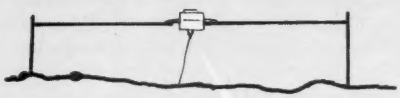
Adjustment. Proper video adjustment requires the agc circuits to have been set up previously. Preset the Contrast control (R20) to the maximum CCW position and preset R31 so that the wiper arm is at ground potential. With the program running and video at the input, adjust R31 to just before the point where the black background starts to gray out. Then adjust the Contrast control for the most pleasing gray-scale response.

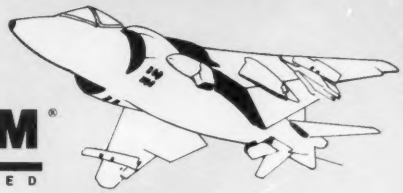
Line Synchronization
(See Fig. 3)

Function. The business of transferring incoming video into memory must be very closely related to the satellite line rate. The actual loading operation is initiated by line-sync pulses which must occur at the same rate at which the satellite video is being transmitted and at the same time a line of satellite video begins. The line-synchronization circuits provide an accurate 2-Hz (120-lpm) or 4-Hz (240-lpm) trigger pulse to control the loading operation and also provide for proper phasing—the ability to shift the position of the line-loading pulse to ensure that it coincides with the beginning of satellite video lines. In addition, provisions are included to ensure the required timing accuracy for both live and tape-recorded imagery.

Operation. The heart of the sync circuit is a phase-locked-loop (PLL) tone-decoder chip (U8) which is designed to lock to a 2400-Hz reference signal at point (2). Sources for this reference tone are discussed under the heading of "Clock Circuits," below. With 2400 Hz applied at point (2), the internal voltage-controlled oscillator (vco) of U8 will lock to this signal since the vco adjustment control (R42) of U8 has been set to free-run near 2400 Hz. When U8 has locked to the tone at point (2), an internal-control transistor pulls low and lights an indicator LED (D9—Sync Lock) to show that lock has occurred. The 2400-Hz vco signal is buffered to TTL levels by Q5 and applied to a set of gates in U9. U9 controls the phasing function which will be discussed below.

For the moment, let us assume that the 2400-Hz vco-derived signal is gated through U9 and on to U10—a divide-by-12 counter. Two outputs are available from U10—a divide-by-6 output (400 Hz) at pin 8 and a divide-by-12 output (200 Hz) at pin 12. U11 is wired as an SPDT digital switch which selects the 400-Hz output in the 240 position of the lpm switch (S3) or 200 Hz in the 120 position. The output of U11 is routed through two decade counters (U12 and U13), providing a total frequency division of 100. With the lpm switch in the 240 position, the output of U13 is a 4-Hz square wave, while in the 120 position it is a 2-Hz square wave. The output of U13 triggers a single-shot





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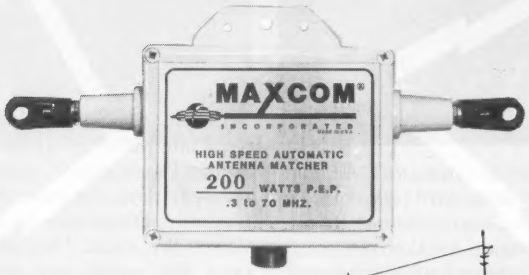

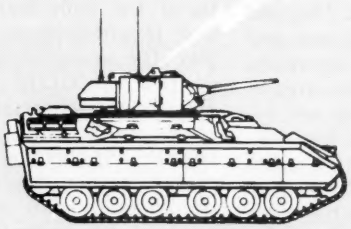

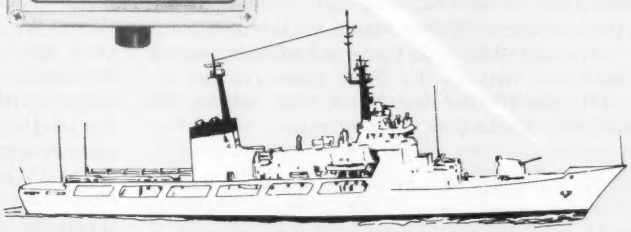

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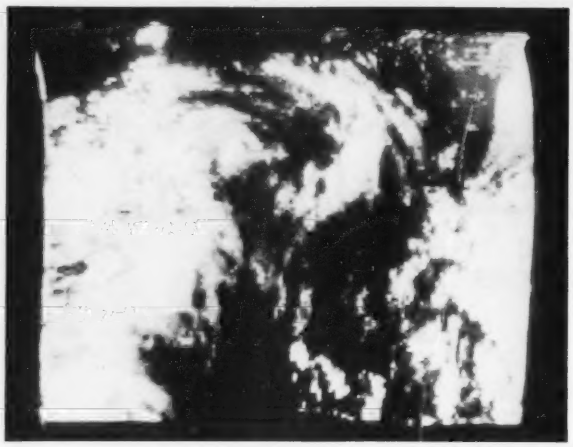

Photo D. A full-frame display of a "standard" 120-lpm Soviet METEOR display. The 120-lpm METEOR imagery does a great job on clouds but land/water features are difficult to discern unless lighting angles are almost perfect. 240-lpm "advanced" METEOR transmissions do a superb job on land/water features but these spacecraft are apparently still experimental and hence their service life seems short; they are on only intermittently.

(U14) which provides a 5-ms line-trigger pulse at either a 4-Hz or a 2-Hz repetition rate. This pulse is buffered by U15 to RS-232 levels to drive the CoCo serial port via the Sync connector (J6) on the rear apron. The Reset switch—a normally-open push-button—is wired to provide +12 V to the RS-232 line for manual reset.

Although the PLL and digital dividers provide the proper line-trigger rate, they are not sufficient to ensure that triggering is in phase—a condition where the line-trigger pulse corresponds to the start of a line of satellite video. Since it is desirable that the interface be usable in a wide variety of FAX formats, a simple manual-phasing circuit is provided. U9A buffers the vco-derived 2400-Hz tone, which then is applied to one input (pin 12) of U9C. The other input (pin 13) is derived from the output of U9B. This input is normally high since one input of U9B (pin 1) is normally held low by the normally-closed Phase push-button switch (S2).

Thus the 2400-Hz reference signal is typically gated through U9C, through U9D (a simple buffer), and on to the divider chain. When the Phase switch is pressed, however, it will open, causing the pin-1 input of U9B to go high. The output of U9B is then controlled by the status of the other input—pin 2. This pin is connected to the Q output of the 5-ms single-shot. Normally this pin is low, but for 5 ms of each line, the SS-trigger interval, pin 2 of U9B is pushed high, causing the output of U9B to go low for the 5-ms trigger interval.

This prohibits the 2400-Hz reference signal from going through U9C for the 5-ms interval, causing a 5-ms counting error once each line pulse for as long as the Phase switch is depressed. This causes the trigger repetition rate to be slowed (by about 2%), and since the trigger rate and the satellite line rate are no longer in step, the edge of the satellite image will migrate toward the left edge of the TV screen when the Phase switch is held open. When the left picture edge is aligned with the left edge of the TV screen, indicating a properly phased display, the Phase switch is released, the output of U9B goes high, and the 2400-Hz signal is gated through U9 without interruption, thus restoring the proper trigger rate.

Construction. The only note here is not to confuse the Reset and Phase push-button switches. The Reset switch is a normally-open type while the Phase switch is normally closed.

Adjustment. With 2400 Hz applied at point (2), adjust the vco adjustment control on the board (R42) until the Sync-Lock indicator on the board (D9) comes on. R42 should be set to the midpoint of the range where D9 provides a solid lock indication. A logic probe on pin 6 of U14 will show a series of short, high pulses indicating the proper operation of the divider chain. The pulses should be noticeably faster in the 240 position of the lpm switch than they are in the 120 position.

Clock Circuits
(See Fig. 4)

Function. The clock circuits are designed to provide a 2400-Hz reference signal for both real-time and recorded-image display. The subcarrier signals of the US GOES and TIROS/NOAA spacecraft are phase-locked to the video line rate and could be used as a frequency reference. Unfortunately, this is impractical for several reasons. In the case of the GOES spacecraft, occasional modulation anomalies will drop the subcarrier black level to 0%, causing the line-sync circuits to lose lock and hence synchronization.

In the case of the TIROS/NOAA spacecraft, signal fades resulting in high noise levels also can cause sync lock to be lost. In addition, the standard Soviet METEOR spacecraft have subcarriers that are not locked to the video line rate and hence cannot serve as a suitable frequency reference. HF FAX signals have a variable subcarrier frequency (subcarrier FM modulation identical to the video swing for SSTV) so that sync lock is not possible with these services.

In order to make the interface compatible with the greatest range of FAX services, a crystal-controlled 2400-Hz signal source is employed. The crystal sync source is used directly during live image

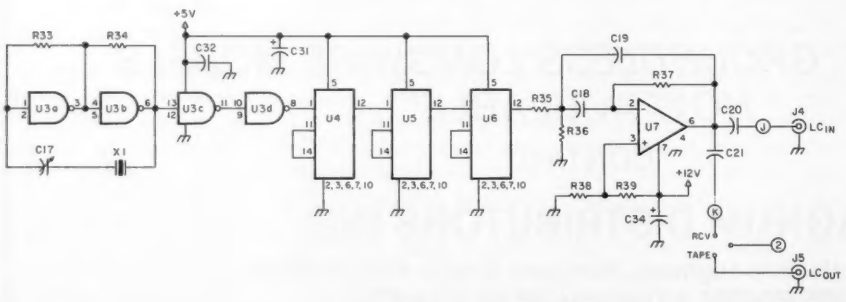

Fig. 4. Clock circuits.

Photo E. Example of High Resolution 1 sampling of an IR WEFAX frame such as in Photo A. It shows a frontal system extending down the central Dakotas into Nebraska.

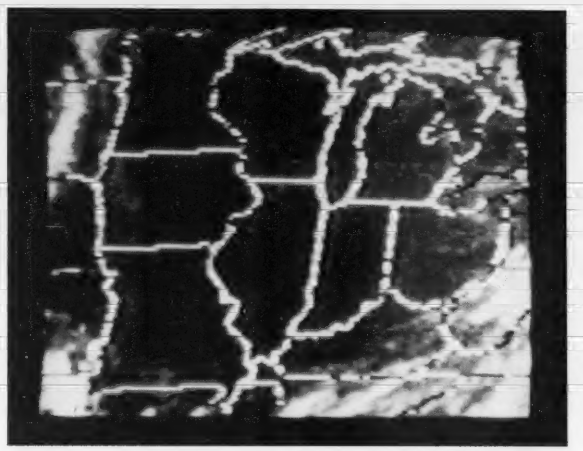

Photo F. The area in Photo E six hours later. In the upper-left corner of the image you can see that the front has intensified and that the system has moved into eastern South Dakota with some low-altitude clouds (indicated by their darker-gray color) moving into western Iowa.

display and is also recorded on the left channel of a stereo tape system while the video subcarrier signal is simultaneously recorded on the right channel. During playback, the line-sync PLL is locked to the recorded tone on the left channel and will effectively track frequency variations caused by tape speed changes during recording and playback, thus maintaining line synchronization.

Operation. U3 functions as a crystal-controlled oscillator/buffer operating at 2.4 MHz with fine frequency adjustment provided by C17. The 2.4-MHz signal is divided by 1000 using three decade counters (U4, U5, and U6). The 2400-Hz square-wave output from U6 is passed through a 2400-Hz active filter stage (U7) to convert the square wave to a sine wave. When the RCV/Tape switch (S1B) is in the RCV position, the PLL tone detector in the line-sync circuit is driven directly by the 2400-Hz crystal reference. A sample of the 2400-Hz signal also is routed to the left channel input of the recorder (LC In) at J4. With the switch in the Tape position, the PLL is driven by the signal recorded on the left channel (LC Out) via J5.

Adjustment. The only operational adjustment is to set the oscillator output accurately to 2.4 MHz by adjusting C17. This can be accomplished in one of three ways:

(1) Connect a frequency counter to pin 8 of U3 and adjust C17 for a frequency of 2.4 MHz to the resolution limits of the counter.

(2) Calibrate a receiver using WWV and a crystal calibrator. Connect a short test lead to pin 8 of U3, loosely coupling the lead to the receiver input. Adjust C17 to obtain precise zero beat at 2.4, 4.8, or 7.2 MHz. The latter frequency is useful for ham-bands-only transceivers.

(3) Display live images using the interface and WEFAX software. If the picture margin drifts to the right as the image reads out, the oscillator frequency is high. If it drifts to the left, the frequency is low. Adjust C17 until the margins are precisely vertical.

Packaging and Power Supplies

There is an old saying in the home construction game that once you have the boards wired you may be almost half done! What kind of packaging you use is pretty much up to you. In the case of the WB8DQT prototype, the display board was placed in its own metal enclosure with a 5-V regulator chip to run the board off the station's +12-V bus. Display-board power drain was measured at 600 mA.

The interface board was dropped into its own cabinet along with a small receiver. The +5-V interface requirements were taken care of with a 5-V regulator chip on-card and the current drain on the +12-V bus was 280 mA. The −12-V drain was minimal—slightly less than 20 mA. Required front-panel controls and indicators include the 120/240 lpm switch, the RCV/Tape switch, the Phase and Reset push-button switches, the Contrast control, and the agc meter. If the power supply is internal, you will also need a power switch and a power-indicator lamp.

The rear apron tends to be a busy-looking place with lots of cables heading off to other gear. There are a total of five audio leads—RCV (receiver output), RC In and LC In (right- and left-channel tape-deck inputs), and the RC and LC Out jacks (tape-deck right- and left-channel outputs)—where you should use standard shielded audio cables (phono-plug terminations) for the interconnections. The Video cable runs from the rear apron to the right joystick port of the CoCo while the Sync cable runs from the interface rear apron to the CoCo serial port. Although not absolutely necessary, it is helpful if the output from the receiver has a constant level—if only to simplify maintaining constant recording levels. A shielded audio lead coupled to the top of the receiver volume control through a .1-uF capacitor should do the job nicely with most receivers.

Tape Equipment

Obviously, the minimal satellite installation consists of the interface, display board, 64K CoCo, and your satellite-receiving gear. In order to make the most of the program features, however, you really should include a good (by music standards) cassette or reel-to-reel stereo tape deck. Regular cleaning and pressure-pad maintenance will keep almost any recorder up to par if you use high-quality tape. Taped transmissions never have

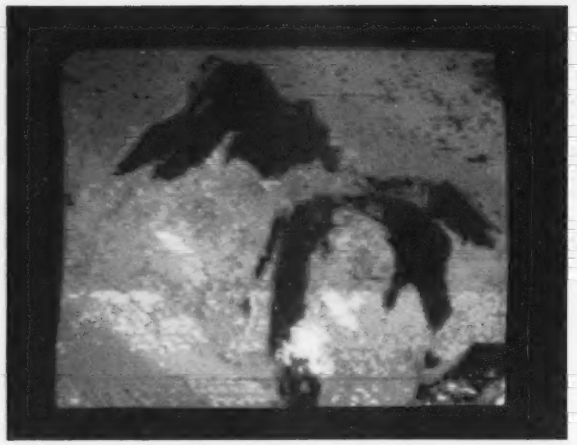

Photo G. A High Resolution 1 image obtained from a NOAA 7 visible-light APT pass showing the Great Lakes in considerable detail. A multitude of small lakes are clearly visible in southern Canada. For the ultimate in high resolution you can use the HR-2 format as shown in Photo H.

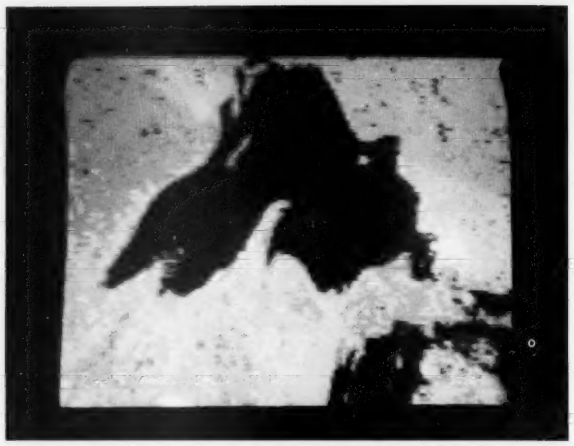

Photo H. The HR-2 format for Photo G. Lake Superior takes up much of the image area. The resolution of the HR-2 format equals the theoretical resolution limit for APT and WEFAX imagery and reveals details that are beyond the capacity of most systems.

quite the quality of "live" displays, but you will rarely notice the difference in practice. All of the photos used to illustrate this article are taken from tape, and the versatility of the program routines possible with tape makes it well worth the marginal loss in image quality.

In order to keep things simple, recordings should be made at constant input and output levels. The output level is easy—simply set it for maximum on both the left and right channels for most decks. Assuming the system has been set up as specified (video into the right channel, sync into the left), you should set the left-channel recording level for 0 VU with the interface running. With the receiver set to an empty channel (no satellite signal), set the right-channel recording level for a mid-range reading (−10 to −7 VU on most decks) using the noise output of the receiver as the signal source.

System Operation

What follows will be a very brief outline of the operation of the major routines in the present WEFAX Rev.3 program available from K6AEP. The software will certainly evolve with time, but most of the evolution will be "bells and whistles" in the sense of new routines. The basic image-display routines should remain fairly stable and you should have little trouble relating the instructions which follow to the extensive program documentation you will receive with your software.

As we discuss program features, we will have occasion to talk about two different displays—what we will call the "CoCo display" and the "image display." The CoCo display is simply the normal computer monitor where prompts, menus, and inputs are displayed. The image display is the monitor where the output of the display board is viewed.

Loading the Program. Insert the cassette and rewind if required. Preset the cassette volume level to about 5, set the cassette recorder to play, type CLOADM, and hit the <ENTER> key. The cassette machine will start to run and an S will flash in the upper-left corner of the CoCo display. The display board and interface should be powered up at this time, but pay no attention to the image display—expect garbage! When the WEFAX program is found, the flashing S will change to a flashing F and a short notice will print out to the effect that the WEFAX program is loading and will execute automatically when loaded. This magic event is easy to spot—you will suddenly get the main menu display (shown in Fig. 6) and the image display will show a random but static pattern based on the contents of the display RAM at power-up.

Virtually everything in the program starts with the main menu, and no matter where you are in the program you almost always can get back to this menu by hitting the <CLEAR> key on the CoCo keyboard. If you find the random-image display a bit disconcerting, you can get a gray-scale display (actually color bars) by typing I followed by G followed by <CLEAR>. If your monitor is like most, you will have considerable vertical overscan on the image display. We would suggest adjusting the monitor height control to compress the display slightly to minimize the loss of picture information at the top and bottom of the screen.

Notes on Contrast Settings. At this point we will assume that the interface has been checked out as noted in the *Adjustment* section of each circuit description. If not, this is the point at which to complete checkout. The only variable that remains to be considered is the proper Contrast setting for each class of satellite. The first time or two you display a given type of picture you can expect to jiggle the Contrast setting until you get the best image display for that mode. Once you have determined the optimum setting for each mode, you should mark it on the front panel. You probably will end up with distinctly different settings for WEFAX, APT Visible, APT IR, 120-lpm METEOR, and 240-lpm METEOR. Alternatively, you may wish to install a small rotary switch on the front panel to switch in a small PC pot for each mode. With the switch positions properly labeled, you need only optimize each pot in turn, after which you can use a switch setting appropriate to the mode you wish to display.

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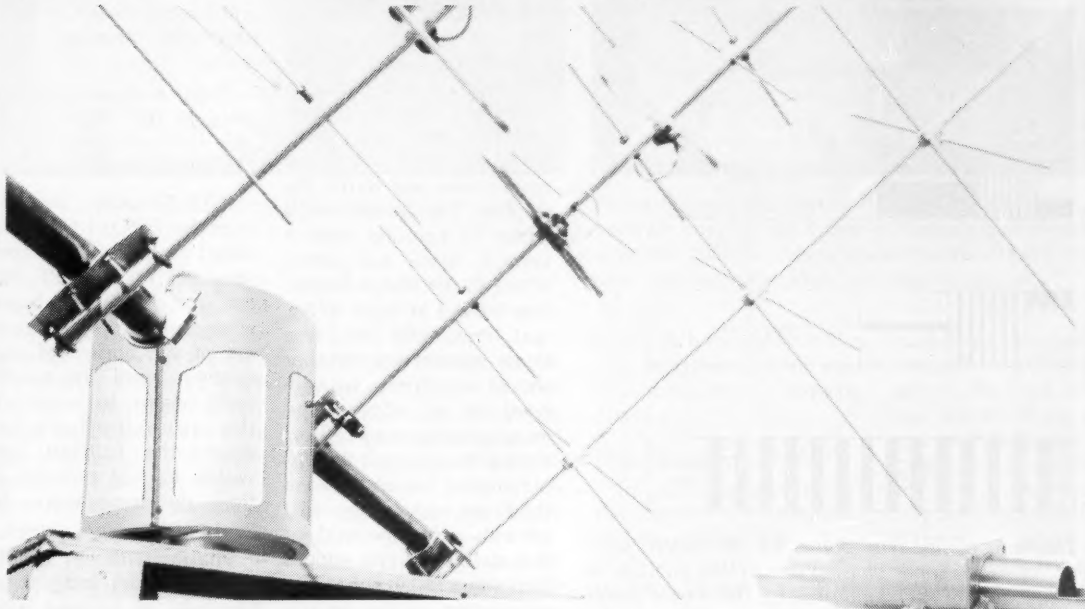

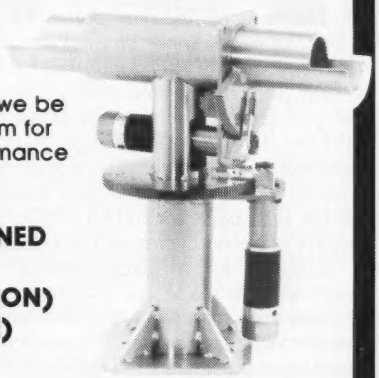

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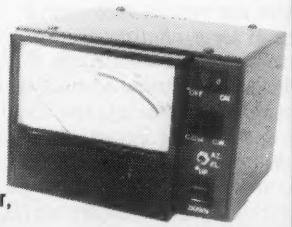

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Primary Image Display

General Notes. The Interface RCV/Tape switch should be set to RCV for "live" display directly from the receiver or to Tape for recorded display. Early experiments are best done with tape as you can always rewind the tape if you make a mistake, or you can display a full frame followed by one of the high-resolution formats, etc.

All image displays will begin with the R option from the main menu. This will reset the image display and the incoming picture will begin to read out. At the same time, a secondary menu (Fig. 7) will appear on the CoCo display and will provide you with your display options following phasing. The image display can be "frozen" at any time by hitting the <CLEAR> key, and the CoCo display will return to the main menu.

WEFAX Display. Set the 120/240 lpm switch to 240. When you hear the characteristic 300-Hz "start" tone, simply hit R from the main menu and watch the display. You should see a white background with a vertical black bar somewhere in the image display area (shown in detail in Fig. 5(a). Press and hold the Phase switch and this bar should march step-wise toward the left edge of the image display area. Allow the bar to move off the display to the left and release the Phase switch. About 20 seconds after the end of the start tone you should hear some rough subcarrier modulation as the picture header begins to print out.

At this point, press key 1 and the WEFAX picture will begin to display from the top of the image display area. When the display reaches the bottom of the screen, press the <CLEAR> key to freeze the image and return you to the main memory. Note that with the US GOES spacecraft the picture starts about 20 seconds after the start tone. The European METEOSAT delays only five seconds, so you will have to hustle to complete the phasing operation.

Photo A shows a typical infrared (IR) WEFAX display, while Photo B is a visible-light example.

APT Display. Images from the TIROS/NOAA satellites are transmitted continuously in the APT format and display can begin whenever the signal rises out of the noise and can continue until the spacecraft begins to approach the opposite horizon. Preset the 120/240 lpm switch to 120 and hit R from the main menu to start display.

Phasing with APT is governed by which image, visible light or infrared, you wish to display. Daylight passes will have both formats available while night passes will have a black visible-light display and only IR data will be useful.

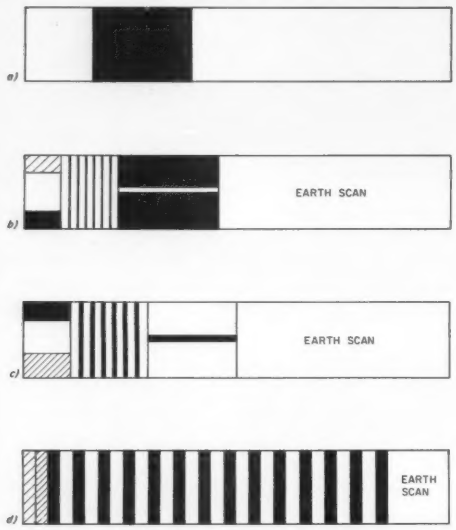


Fig. 5. Diagrams of line-sync pulses for the various satellite-video formats. Proper phasing of satellite pictures requires recognition of each kind of pulse. The Phase switch is pressed until the desired sync pulse moves across the screen and just off the left edge of the display. (a) shows the WEFAX line pulse—a simple black bar on a white background. It is transmitted during the phasing interval at the start of a GOES or METEOSAT frame transmission. (b) shows the sync pulse for NOAA visible-light APT imagery. It consists of seven cycles of 1040-Hz subcarrier modulation, followed by a black interval representing the scanner's view of space just prior to the start of the earth scan. Once each minute a white minute marker bar will interrupt the black space scan. The essential cues for the visible-light sync pulse are the black space scan and usually high-contrast video in the earth scan. Just to the left of the pulse train is a telemetry signal that is displayed as horizontal gray-scale data. (c) shows a typical infared (IR) line pulse in the NOAA APT format. This pulse is also seven cycles in length but it is seven cycles of 832-Hz modulation so it is somewhat wider than the visible-light pulse. The IR pulse is followed by a white interval (cold) representing the space scan. The earth scan is typically quite white and low in contrast. IR minute markers are black. To the left of the pulse is a telemetry gray-scale pattern similar to that of the visible-light pulse. (d) is the line-sync pulse for standard 120-lpm METEOR imagery—a long 13-cycle pulse that is very easy to recognize. The earth scan data is immediately to the right of the pulse while vertical gray-scale stripes are immediately to the left of the pulse. All of these pulses are enlarged illustrations—much as you might see with the HR-1 or HR-2 display formats. They are quite easy to recognize in full-frame display however, once you are familiar with their appearance.

```
I — TEST INTERFACE
R — RECEIVE HIGH DENSITY FAX
L — RECEIVE LOW DENSITY FAX ON TRS80C
D — DISPLAY IMAGE IN MEMORY
Y — MEMORY CHANGE
C — DISPLAY COLOR IMAGE IN MEMORY
T — PRINT PICTURE ON SCREEN
S — SELECT PRINTER SPEED
E — CONTRAST ENHANCE PIX
UP DOWN ARROW PICT UP DOWN
```

Fig. 6. Main menu display, WEFAX program.

```
WHILE VIEWING A FAX PIX
KEY 1 = WEFAX, APT, ADV METEOR
KEY 2 = STND METEOR
KEY 3 = HIGH RES 1
KEY 4 = HIGH RES 2
KEY 5 = HF FAX FAST
KEY 6 = HF FAX SLOW
KEY R = ROTATE PICTURE
ANY OTHER KEY WILL END
```

Fig. 7. Secondary display menu, WEFAX program.

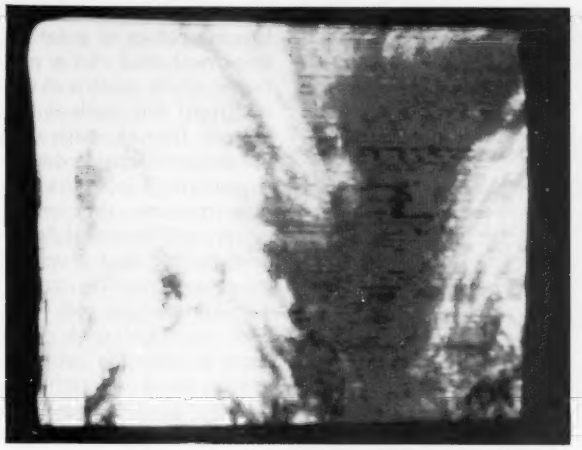


Photo I. Polar-orbit infrared (IR) imagery in low contrast.

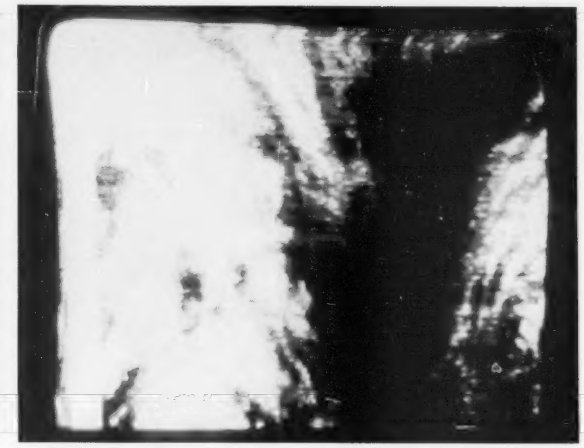


Photo J. Once the display has been optimized using the Contrast control, the image in memory can be enhanced using the contrast enhancement routine. Unlike other routines, enhancement alters the image in memory.

The visible-light sync-pulse train is shown in Fig. 5(b) while the IR-sync-pulse sequence is shown in Fig. 5(c). To display visible-light imagery, simply press and hold the Phase switch until the visible-light sync pulse passes off the left edge of the display. If you want IR display, simply hold the Phase switch until the IR pulse has moved off the left edge of the image display area. With either visible or IR phasing complete, hit key 1 to restart the display from the top of the image display area.

With a simple omnidirectional antenna you can expect to receive at least 10 to 12 minutes of imagery on a good pass. If you keep the display going unattended, the image will automatically reset as it reaches the bottom of the screen. For the first look at a pass, you may wish simply to let it scroll in this fashion. Once you have an idea of the features of interest, you can run the tape again and when you get to the point where you want to display the material, simply hit either the interface Reset switch or key 1 on the keyboard. Once the display fills up, simply hit <CLEAR> and the image display will be frozen while the CoCo display returns to the main menu. Photo C shows a sample of visible-light imagery from a daylight APT pass.

METEOR Display. Soviet polar-orbiting METEOR spacecraft come in two varieties—the standard 120-lpm spacecraft and the rarer 240-lpm birds which are apparently still experimental. Both types of METEOR imagery are restricted to visible-light data from daylight passes. For 120-lpm METEOR display you should preset the 120/240 lpm switch to 120 and hit R from the main menu to start display. The 120-lpm "standard" METEOR sync pulse is shown in detail in Fig. 5(d). As the image reads out, press and hold the Phase switch until the sync-pulse train marches out of view to the left of the image display. Release the Phase switch and hit key 2.

Like the APT format, METEOR pictures are continuous and you can scroll through an entire pass or hit the Reset switch to reset the display whenever desired and the <CLEAR> key to freeze the image display and return to the main menu. Photo D illustrates the results from a typical "standard" METEOR pass.

240-lpm "advanced" METEOR operation is similar except that the 120/240 lpm switch should be in the 240 position and you should hit key 1 following phasing.

High-Resolution Display

In order to provide for the display of extremely-high-resolution data, two high-resolution formats, High Resolution 1 and High Resolution 2, are supported by the WEFAX program. In each we sample a progressively smaller subset of the image with the capability of resolving finer detail. Prior to using one of these formats, you should display the entire image of interest to determine what features you wish to emphasize. Once this has been done, note some easily-recognized feature a short distance above the feature you are interested in. This feature will be the "recognition" feature and will tell you when you should shift to the high-resolution mode.

High Resolution 1. This is an intermediate format that will exceed the resolution limits of most CRT systems and many FAX displays. Assuming you have located the picture-area of interest to you and a suitable recognition feature, begin display with the main-menu R option and proceed to phase the image. In this case, however, you should phase the image so that the feature of interest will read out on the left half of the image display area. Key either 1 or 2 (depending upon mode) and watch for the recognition feature. As it begins to read out, simply hit key 3 and the High Resolution 1 sampling will begin. When display is complete, hit <CLEAR> to freeze the display and return to the main menu. Examples of HR-1 images are provided in Photos E and G.

High Resolution 2. The resolving power of this format exceeds that of any of the satellite formats and you can expect to see details that almost no one else can resolve. Start with R and phase the display so that the feature of interest will read out just to the right of the left image display margin. Key either 1 or 2 and watch for the recognition feature. As it starts to read out, hit key 4 and your HR-2 image will load quickly. Press <CLEAR> to freeze the display and return to the main menu.

An example of the HR-2 format is provided in Photo

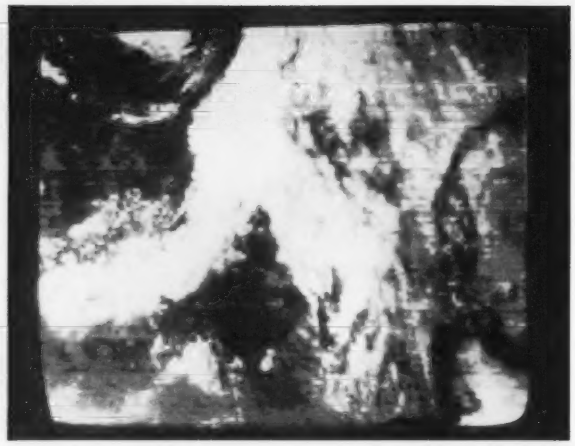


Photo K. A full-frame display from a NOAA polar-orbit pass. The Great Lakes region is buried under a huge compound frontal system shaped like an upside-down V. Now see Photos L and M.

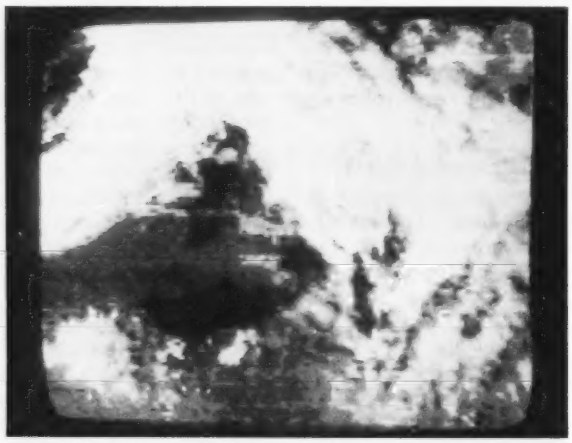


Photo L. An HR-1 display of the center of Photo K. The southern part of Lake Huron and all of Lake Erie can be seen between the open angle of the "V".

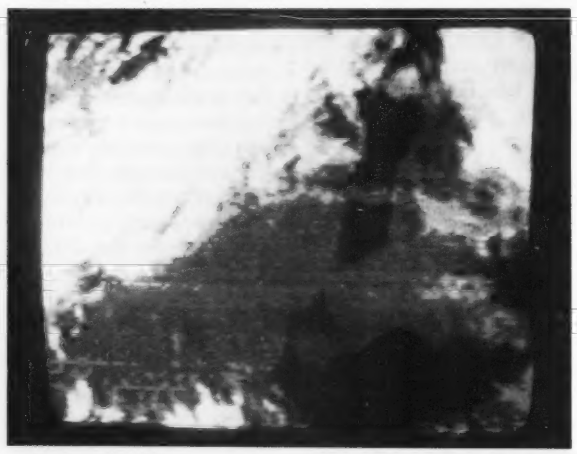


Photo M. An HR-2 view that reveals even greater detail, including a cloud "stringer" stretching across Lake Huron, a feature that is invisible in Photo K and barely resolvable in Photo L.

H. This is a demanding format due to the small area sampled but if you don't quite capture the area you want, simply run the tape back and try again. As you can see, the results are well worth the effort!

Display Options

Although most people would be quite happy just to be able to capture the full-frame or high-resolution formats, there is still quite a bit that can be done once the image is in memory! To access these functions, simply type D from the main memory and you will get a menu like that shown in Fig. 8(a). The functions you will use most often on this menu are summarized below. You can try these options in any order and as often as you like. Although the display will change with each option, the original picture will remain unaltered in the main memory.

(a)

```
DISPLAY PIX IN RAM
L = LOW DEN PIX
R = ROTATE PICTURE
T = TOP HALF
B = BOTTOM HALF
P = TOTAL PIX
1 TO 8 QTR FRAME
```

(b)

```
. . . . . .
. 1 . 2 .
. . . . . .
. 3 . 4 .
. . . . . .
. 5 . 6 .
. . . . . .
. 7 . 8 .
. . . . . .
```

(c)

```
. . . . . .
.         .
.    T    .
.         .
. . . . . .
.         .
.    B    .
.         .
. . . . . .
```

Fig. 8. (a) Display options menu. (b) and (c) Zoom formats.

Picture Rotation. South-to-north passes of polar orbiters will read out a picture in which south is at the top (start) and north at the bottom (finish); basically, the picture is upside down! If you type R from the display memory the image display will be rotated 180 degrees, and such inverted images will now be upright with north at the top. This neat software trick sure beats turning the monitor upside down or standing on your head to view the image!

Top and Bottom Image Subsets. Although the image in memory is stored in a 256 × 256 format, the standard display board format is 256 × 128, which means you lose some vertical resolution relative to the picture actually in memory. You can get all the resolution in memory by hitting either T or B, displaying the top or bottom half of the image in memory, using the entire image display area. Although this will distort the aspect ratio slightly—the pictures will appear "stretched" vertically—it is a quick way to look for fine detail that may be lacking in the full-frame format. The T and B formats are shown in Figs. 8(b) and 8(c).

Image Enhancement. IR imagery—particularly APT—can appear quite white and washed out, especially during the winter months, due to a lack of strong temperature differences between land and sea surface and overlying clouds. Careful adjustment of the Contrast control will help, but the pictures still will be pale compared to their visible-light counterparts. The E option from the main menu can help out in such cases. Once you have captured the picture you want, you can enhance contrast by a factor of 1.5 by typing E from the main menu.

When you do so, there will be a slight delay and then the E you have typed will disappear. If you type D followed by P, you can see your enhanced image. An example of a standard and an enhanced picture can be seen in Photos I and J. *Note that this routine should be used with care!* Unlike all the other routines discussed so far, it permanently changes the image in memory! If you don't like the results, you will have to reload the picture from tape to get the original version back on the screen. Also, although there is no limit to how many times you can run the E routine on a picture, the image will tend to degrade steadily after the first enhancement run. You can try additional passes through the routine if the first did not get you all that you expected, but don't say you weren't warned!

Hard Copy. One of the beauties of scan conversion is that you can view a large number of satellite pictures without piling up costs for photographic supplies or FAX paper. Obviously, however, there will be times where you would like to have a permanent copy of a particularly interesting picture. Photographing the TV display is one option, and you can use relatively economical roll film since you do not need the pictures immediately.

A second option is to use the T routine from the main menu. This will permit you to print the image being displayed using an Epson printer (MX-80 with the Graphtrax option, or the newer RX-80). An example of a full-frame printout is shown in Fig. 9. Full-frame printouts will have lower resolution than the image displayed but will be quite useful in most applications. The resolution of printouts from High Resolution 1 images is equal to that obtained with many CRT display systems. The advantage of the printer approach to hard copy is that the printer is useful in all other applications of your CoCo, so your hardware acquisition will have multiple uses.

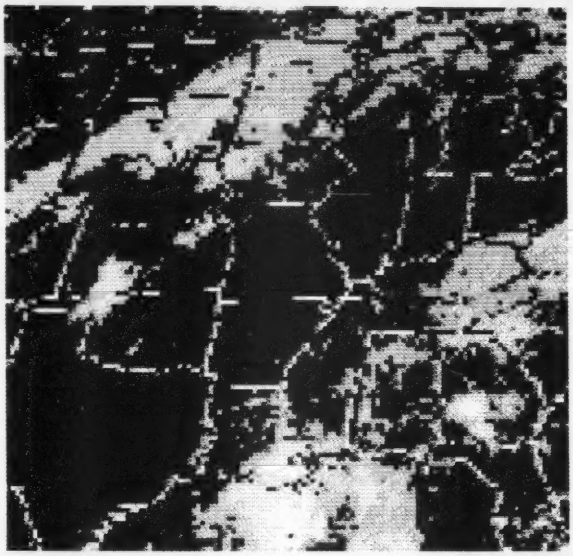


Fig. 9. An example of image printout using an Epson RX-80 printer. This is an HR-1 image from a GOES E infrared image of the United States (as in Photo A). This HR-1 view extends from Texas in the lower left to northern Florida in the lower right. Michigan is in the upper right and the US/Canadian border runs along the top. IR images display cold objects as white. The ground surface is warm and hence dark. Most of the cloud features in this view are mid-range gray, indicating relatively warm (and low) clouds. The white centers of the clouds in the Gulf of Mexico and southern Georgia indicate colder and higher cloud features.

Low-Density TRS-80C Display

Most of the remaining main menu functions that are available will not be discussed as they are more specialized and space is limited. The exception is the L routine which appears on the main menu and also on the display menu. This is a routine that will print a low-resolution, limited gray-scale version of a satellite picture directly on the TRS-80C display monitor without the use of the high-resolution display board. If you use a color monitor you should disable the color when using this option. The picture is quite crude and the routine is perhaps best used to check out the interface functions prior to getting the display board on line. This routine will not be supported with future program revisions and may eventually be dropped if other new routines have a higher priority.

High-Frequency FAX

Weather charts and almost any imaginable kind of picture material are transmitted regularly on HF (SSB) using various FAX formats. All of these have a video "swing" identical to that of SSTV—1500-Hz black to 2300-Hz white. Since HF video is identical to SSTV video, you can simply drive the CoCo joystick port with the output of the SSTV demodulator while driving the serial port with this month's interface to provide line sync. The only change in recording an HF FAX signal is to route the output of the HF receiver to the right-channel input with the right-channel output going to the input of the SSTV demodulator.

The single biggest problem with FAX is that the signal does not contain a 1200-Hz sync pulse, and since there are no intervening voice transmissions, the signal can be difficult to tune on SSB. One possibility is to wire up a pair of NE567 tone decoders with LED indicators, one tuned to 1500 Hz (black) and the other to 2300 Hz (white). The circuit values shown for U8 on the interface should do just fine for such decoders. Phasing on HF FAX usually uses one of two formats—white video with a black framing marker or black video with a white framing marker. In either case, if you tune so that both indicators flash during phasing, you will be right on frequency.

HF FAX uses several standard line rates—typically 120 but also 60 and 240 lpm. Begin by typing R from the main menu and phase the picture. You can then try keys 2, 1, 5, and 6 in sequence to see which gives the best display for the transmission in question. Once you have identified the proper key for a specific station, you should log the information for future use. Again, as in the case of satellite transmissions, recordings will let you experiment as long as desired to determine the optimum display format. Weather charts will tend to be disappointing due to the large amount of fine detail, but wirephoto transmissions yield excellent results. The press frequencies for this sort of thing are not widely publicized, but several books are available listing these and other "confidential" HF frequencies.

Parts List
(Weather-Satellite Interface)

Transistors

Q1–3, 5	2N4401 (General purpose audio NPN)
Q4	2N4403 (General purpose audio PNP)

Integrated Circuits

U1	LM1458 (Dual 741/Mini-DIP)
U2	LM324 (Quad op amp)
U3, 9, 11	SN7400N (Quad NAND gate)
U4–6, 12, 13	SN7490N (Decade counter)
U7	LM741CN (741 op amp/Mini-DIP)
U8	NE567 (PLL Tone decoder)
U10	SN7492N (Divide-by-12 counter)
U14	SN74121N (Single-shot)
U15	MC1488P (RS-232 Line driver)

Diodes

D1–7, 10	1N4001
D8	5.1-V, 1-W zener
D9	Radial mounting LED (sync lock)

Resistors

All values in Ohms. Unspecified units are 1/4 W, 5% composition or metal film. PC indicates A 1/4- to 1/2-W printed-circuit pot. Panel mounting indicates a standard panel-mounted pot.

R1	10k PC (agc threshold)
R2, 4, 32, 47	4700
R3	47k
R5, 6, 16, 21, 22, 24, 26, 29, 30, 35, 38, 39, 41, 48	10k
R7, 12, 15	56k
R8, 14	120k
R9	22k
R10, 19, 44, 45, 46	1000
R11	1
R13	6800
R17, 36	2700
R18, 23, 37	20k
R20	10k Panel mounting (contrast)
R25	1 megohm
R27, 28	2200
R31	1000 PC (black level)
R33, 34	470
R40	150
R42	5000 PC (vco adj)
R43	1500

Capacitors

Unless otherwise noted, capacitors should have a working voltage of at least 16 V. T indicates a dipped tantalum electrolytic, A an aluminum electrolytic (radial leads), M a dipped mylar™/paper capacitor, D a disc ceramic capacitor, SM a silver-mica capacitor, and MT a mica compression trimmer. All capacitance values in uF unless noted.

C1, 6, 7, 16, 26, 39	1 T
C2, 3	22 T
C4, 9, 10, 18, 19, 28	0.01 M
C5, 38	10 T
C8	100 A
C11, 12, 20, 21, 24, 25	0.1 M
C13	27-pF SM
C14	0.22 M
C15	0.047 M
C17	40- or 60-pF MT
C22	2.2 T
C23, 31, 35	4.7 T
C27	120-pF SM
C29, 30, 34	0.1 D
C32, 33, 36, 37	0.01 D

Misc.

X1	2.4 MHz at cut crystal/32-pF load/0.002%
M1	50-microamp panel meter (agc)
J1–7	Switchcraft 3501FR or other phono jack
S1	DPDT subminiature toggle (RCV/Tape)
S2	Normally-closed push-button (Phase)
S3	SPDT subminiature toggle (120/240 lpm)
S4	Normally-open push-button (Reset)
S5	SPST toggle (power if supply internal)
L1	12–14-V LED or other panel lamp (power)

The Future

The present CoCo FAX system offers extreme flexibility and excellent results. One of us (WB8DQT) has all kinds of CRT and FAX display systems but has used little but the CoCo since we got the system up and running. If new routines prove to be useful or if new FAX formats appear, they will be added to the software in an attempt to keep it as current and useful as possible. The guiding philosophy will be that inexpensive software upgrades are preferable to making extensive hardware modifications.

There is a hardware option, however, where you can expect to see developments—the display board. The basic high-resolution display board is limited to a 256 × 128 format since only 16K of static RAM is used. Despite this limitation, the FAX results are quite good as evidenced by the photos in this article—all of which were photographed from that standard display-board output. Some experimentation by K6AEP has shown that it is practical to load the display board with as much as 32K of static RAM—enough to provide a 256 × 256 display format!

By the time this article appears, Multimode and L. W. Interface will offer both versions. The 256 × 256 version is obviously a bit more expensive, but the display is capable of pushing the resolution limits of most monitors. The WEFAX Ver. 3 software has been modified (along with various SSTV options) to support either 256 × 128 or ×256 display. You can start with and stay with the first or later upgrade to the second and still use the same software.

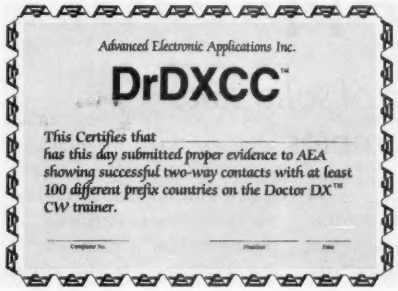
Conclusion

Up to this point in time the differences in image formats and the equipment required for image processing have kept the various types of video experimenters separate and distinct. One of our goals has been to use the power of the 6809 microprocessor as a flexible image-processing system. With the power of a 64K CoCo, some hardware interfaces, and flexible software, the segregation of ATV, SSTV, FAX, and the weather-satellite crowd is a thing of the past—not to mention CW and RTTY! For about what you would pay for a dedicated system for any one of these modes, you can have it all!

If you stop to think that the same computer can calculate satellite orbits, keep your log, balance the checkbook, and teach the kids, we think you will agree that it will be a much easier job to sell the family on the "new" gear. Of course everything has its price. Once you are geared up you will have the terrible decision about which of all those modes you want to use when you fire up the rig! For that weighty question we can suggest only that you write a program to let the computer decide! ■

Doctor DX™ Challenge

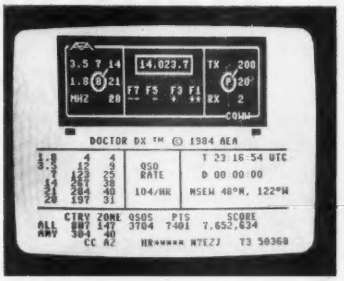
BY AEA


Advanced Electronic Applications Inc.
DrDXCC™
This Certifies that
has this day submitted proper evidence to AEA showing successful two-way contacts with at least 100 different prefix countries on the Doctor DX™ CW trainer.

DOCTOR DX CONTEST BOX

TOP SPRINT SCORES	TOP MARATHON SCORES
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.

WILL YOUR CALL APPEAR HERE?



For good clean, competitive fun, Doctor DX™ shows your score and QSO rate for continuous monitoring of your improved CW operating skills. The DDX-64 can be a vehicle for fairly settling those club rivalries by competing with your friends under identical operating conditions.

AEA also has two on-going CW contests that you can enter with Doctor DX as your own schedule permits. The AEA SPRINT CONTEST is a timed non-stop eight hour event and the AEA MARATHON CONTEST is a timed 24 hour non-stop event. The top 5 contest scores will be published in our future advertisements and upgraded periodically as new higher scores are achieved.

In addition to the two AEA contests, we are offering award certificates for achieving certain milestones. You will be automatically alerted when you have achieved these milestones by a display at the bottom of the monitor screen.

AEA DrDXCC is achieved when you have worked 100 different countries, regardless of the frequency band or the amount of time operated. DOCTOR DX WAZ can be earned by working all 40 CQWW zones of the world, without regard to the band or duration of operating time. The DOCTOR DX HONOR ROLL is reserved for top notch operators capable of working 250 countries without regard for band or operating time. Additional endorsement awards are available for each additional 10 countries worked up to 300 (out of 304 possible) countries. AEA 5 BAND Dr DXCC is a very difficult award to achieve. It requires working 100 countries on each of five different bands, without regard for the amount of operating time.

Each award can be obtained by filling out a photocopy of the award application form (supplied) along with the score information and qualifying check sum from your screen display. Please enclose $3.00 to cover handling costs for each certificate ($1.00 for Honor Roll endorsements). Awards will only be granted to owners having a Doctor DX warranty card on file.

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Bob Myers KCØEW
413 Edgewood Drive
Loveland CO 80537

Transistors: A Biased Approach

In Part I, KCØEW takes the mystery out of solid state with clear talk and practical examples.

Sometimes I think things were a lot simpler in the "good old days"—you know, vacuum tubes and all that. Then, you could visualize the electrons happily zipping from cathode to plate, with a varying charge on the grid adjusting the flow. You even had a nice orange glow from the filament when you turned the thing on, a reassuring visual indicator that something was happening. The transistor changed all of that—now all we have to look at are little metal cans that look just the same, on or off. And the way they operate! All this talk about "electron/hole pairs" and "minority carriers." It's a miracle anything ever gets designed with these things, they're so hard to understand.

Wrong. Transistors aren't much more complicated than any other electronic device (they can be a lot simpler than tubes in many cases), but they do have their own way of operating, and once you've learned a little about it and how to use them, everything's simple. So, let's get with it. I'm not going to cover any solid-state theory here, just how to use these things in something practical. Maybe we'll look at the theory some other time.

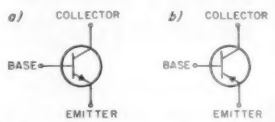

Fig. 1. NPN (a) and PNP (b) transistors.

Your basic, garden-variety bipolar transistor has exactly three leads—emitter, collector, and base. You can find which is which for the particular part you're working with by checking the data sheet, but all transistors share two basic properties in normal operation. First, the current flowing from collector to emitter is some multiple of the current flowing into (or out of) the base lead. Second, the voltage drop across the emitter and base is constant. This applies only when operating in what's called the "active" mode, but we'll get to that in a moment.

Fig. 1 shows the two types of bipolar transistors: the NPN, (a), which is drawn with the arrow on the emitter pointing away from the base, and the PNP, (b), drawn with the arrow pointing in. As a general rule, anything you do with one, you can do with the other if you swap all your polarities—a positive supply becomes a negative supply, etc. Fig. 2 shows this. Here, the two transistors are shown with voltages set up between the three leads to put them in the active mode. (Properly arranging the voltages, currents, or whatever on a transistor or any other device is called "biasing," and that's what this article is all about.) For the NPN transistor to be active, the collector must be more positive than the base, which in turn must be more positive than the emitter. The PNP is just the same, but here the collector is more negative than the base, and so on. We'll limit our discussion to the NPN, but remember that everything will also apply to the PNP—just turn the voltages and currents around.

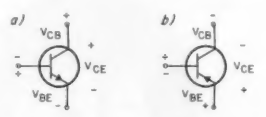

Fig. 2. The NPN (a) and PNP (b) transistors biased for the "active" mode of operation. Note that the only difference is the polarity of the voltages.

The active mode of operation is the one most often used in linear circuits such as amplifiers, and in this mode the transistor is indeed acting as an amplifier. The current flowing into the collector lead is directly proportional to the current into the base lead. The other two modes possible are "cutoff" and "saturation." Cutoff is exactly what you'd think—the transistor is turned off and no current flows at all. This occurs when (for the NPN) the base is less positive than the emitter. Saturation occurs when the base is more positive than either the collector or emitter and means that the transistor is passing all the current it can for that particular biasing. (Note that saturation *does not* mean that the transistor is carrying its maximum rated current, only that it's carrying all that's possible for that particular setup.)

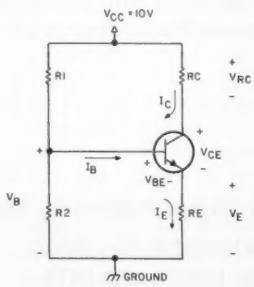

Fig. 3. An NPN transistor with a network of resistors for biasing.

There's another way to look at the modes of operation we've just discussed. The transistor can be viewed as two diodes, one from base to emitter and the other from base to collector. (You can see it in the names

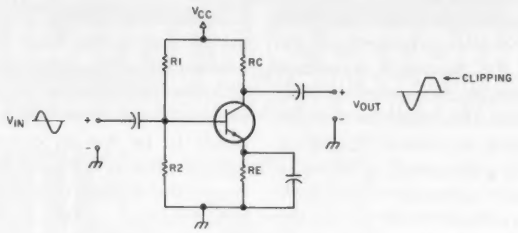

Fig. 4. A simple transistor amplifier. If the dc level at the collector is too high for the signal level expected, the output may clip as it tries to exceed the limit set by the supply voltage (Vcc).

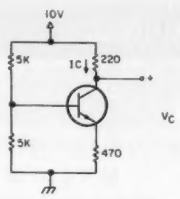

Fig. 5. The NPN transistor with some values for the biasing resistors. Ignoring beta, this circuit gives Vc = 8 V and Ic = 9.2 mA.

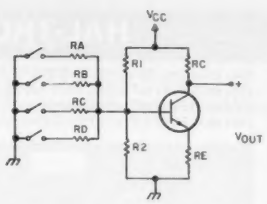

Fig. 6. A simple digital-to-analog converter (DAC). As various resistors are grounded through their switches, the voltage through the base, and therefore the output voltage, changes.

NPN and PNP—two P-N junctions, or, in other words, diodes.) A transistor is active when the base-emitter diode is "forward-biased" (positive on the P side and negative on the N side) and the base-collector diode is "reverse-biased" (positive on N, negative on P). Either way, you can tell how a transistor is operating just by figuring out how the voltages are arranged around the three leads.

Fig. 3 shows an NPN transistor along with four resistors which we can use to establish the "dc operating point," in other words, to bias the transistor for proper operation. The dc operating point is usually specified in terms of the collector current and the collector voltage when no signal is applied. It's important because it will affect the operation of any circuit we build with the transistor.

For an example, let's suppose that the transistor is being used as an amplifier, as in Fig. 4. With the supply voltage (Vcc) at ten volts, the collector voltage will determine how far the output can swing before clipping. If, say, the collector is at 7 volts, we'd better not expect to get a signal out that swings any more than 3 volts positive—if it does, it'll run into the limit of the supply voltage and clip. This isn't the only way the operating point is important, but you can see that it's not something to ignore. On to biasing.

Remember the two points I made earlier: that the voltage drop from base to emitter is constant and that the current flowing in the collector lead is some multiple of the base current. The number you multiply the base current by to get the collector current is called *beta*. This may also be given as the Greek letter, β. Both of these will affect the operation of the transistor in any circuit, but beta is usually the more difficult of the two to handle. Not only will beta vary from part to part (sometimes by as much as five to one or more), but even the beta of a given transistor will wander around as the temperature, collector current, etc., change. Designing for a stable operating point for varying betas is really what biasing is all about. Now, some practical examples:

For our first try, we'll ignore the base current of the transistor and thereby ignore beta. This really isn't such an unreasonable thing to do since if beta is high enough (and most small-signal transistors sport a beta of at least 100), the base current really is negligible compared to the collector current. We'll use the NPN with a resistor network for biasing, as shown in Fig. 3. Now, if we ignore the base current, we can very quickly get some expressions for the currents and voltages in this circuit.

The point we're interested in is the collector—we want the voltage at the collector and the value for the collector current which is flowing through Rc. Obviously, by Ohm's Law, there must be a voltage drop across Rc of VRc = Ic × Rc, so the voltage at the collector is just Vc = 10 V − VRc. The emitter current must be the same as the collector current (we're ignoring the base current, remember?), so the voltage at the emitter (the voltage across Re) is VRe = Ic × Re.

Wait a minute! If the drop from base to emitter is constant, then the base will always be a certain amount more positive than the emitter. This drop is around 0.7 volts for a silicon transistor, so Vb = Ve + 0.7. Again, we're ignoring the base current, so Vb may be determined easily—R1 and R2 are just a divider, and Vb = 10 × R2/(R1 + R2).

Working backwards through the relations we discovered above, we can get the collector current (same as the emitter current) as Ic = ((10 × R1/(R1+R2)) − 0.7)/Re.

Fig. 5 shows the same circuit with some values for the resistors. Using the above formulas, we can find the voltage at the base to be Vb = 10 V × (5k)/(5k + 5k) = 5 V and the voltage at the emitter to be Ve = 5 V − 0.7 V = 4.3 V. The emitter and collector currents are then Ic = Ie = 4.3 V/470 = 9.2 mA and the collector voltage must be Vc = 10 V − (9.2 mA × 220) = 8 V.

If you build this circuit (any small-signal silicon NPN should work), you should measure voltages very close to the ones we just calculated. As a matter of fact, just using this type of analysis can allow us to design a practical circuit.

What would happen, for example, if we could switch the values of R1 and R2 around at will? One easy way to change this divider would be to put other values in parallel with R2, which will lower the resistance from base to ground. We might do this as shown in Fig. 6, with several different resistors tied together at the base and then individually switched to ground. A resistor whose switch is open would simply "float" and make no difference to the circuit whatsoever. Switching different combinations of resistors in and out would vary the voltage at the collector. If we chose the values of these resistors properly, we could use this circuit as a digital-to-analog converter, or DAC. DACs are used extensively to allow digital circuits, such as are found in microcomputers, to control analog voltages.

Fig. 7 shows a practical version of this simple DAC. As the binary representation of the numbers 0 to 15 is fed into the 74LS05 (a 7405 or 74S05 works just as well), the output (at the collector) will change in even steps from a maximum to a minimum value. If the DAC is driven by a counter, such as

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the 74LS163 shown in Fig. 7, the process will repeat over and over again and the output will appear to be a "sawtooth" wave. With the values shown, the maximum voltage at the output will be around 10–11 V and the minimum 2–3 V. (These will vary somewhat due to part tolerances and variations in the base-to-emitter voltage.) The 555 timer provides the clock for the counter, here at about 16 kHz. The output frequency will be 1/16 of this value, or about 1 kHz.

If you build this circuit and have access to an oscilloscope, be sure to look at the signal on the base when the counter is running. Notice that it appears to be a smaller, inverted version of the sawtooth waveform seen at the collector. Surprise! The transistor is really acting as a simple amplifier, taking the small signal we've made at the base and making a bigger copy of it at the collector. (The inversion of the signal is characteristic of this type of amplifier.)

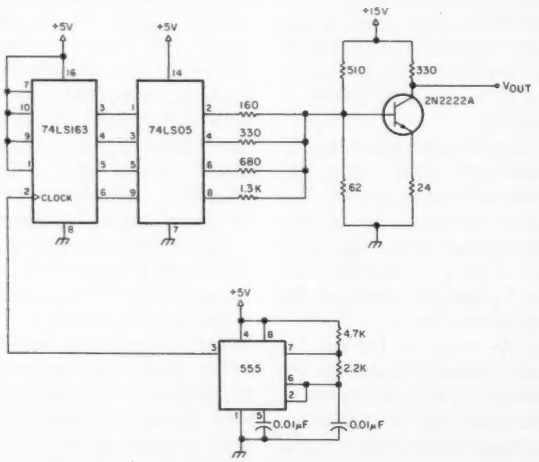

Fig. 7. The DAC used to generate a "sawtooth" waveform.

You may want to try your hand at designing one of these yourself. First, a word of advice: This is never going to be a very classy way to make a DAC, and variations in the resistors or the transistor itself can, as noted above, cause the output to change from the designed value by quite a bit. But it's kind of fun to try these things for yourself, so here's how.

The 7405 is an inverter with "open-collector" outputs. This means that the output pin is simply the collector of a transistor, and when an input is high, this transistor is switched on and effectively takes the output (the collector) to ground—the transistor, in other words, saturates. It won't actually make it all the way to zero volts—there will always be some small drop across this transistor, around 0.2–0.3 V. We can assume about 0.25 V for the purposes of this design. Thus, a high input will pull the resistor associated with that bit to 0.25 V. The drop across the resistor is the base voltage minus 0.25 V. We start by setting up Re, Rc, R1, and R2 for the desired minimum output voltage at the collector. In this stage of the design, assume that all of the "extra" resistors are floating—they can be ignored.

With the minimum voltage established by the basic biasing network, we can add the extra resistor to pull the base voltage down and so increase the collector voltage. If you want to use a straight binary input such as the one shown here, calculate the value of the smallest resistance (the most significant bit of the input) first. This may be done by figuring what the base voltage needs to be for an output voltage that's halfway between the desired minimum and maximum—this *is* the most significant bit, remember? Given this voltage, the current through R1 is found by subtracting this base voltage from the supply and dividing by the resistance of R1. Since we're ignoring the base current, the sum of the currents through R2 and Ra must equal the current through R1, and so we find the current in R2 next. This is simply the desired base voltage divided by R2. Subtracting this current from the current in R1 gives the current that must be drawn by our most-significant-bit resistor, Ra. The value of Ra is just the drop across Ra divided by this current, or Ra = (Vb − 0.25)/Ia.

The remaining resistors may be calculated in a similar fashion, or for a straight binary DAC, each resistor will be twice the value of the one for the bit to the left. If we want a four-bit DAC, such as the one shown, and we calculate Ra to be 500 Ohms, then Rb = 1000 Ohms, Rc = 2000 Ohms, and Rd = 4000 Ohms. Use the nearest value available and use the most precise resistors available for best results.

With this example, we've learned in a very basic way how the transistor may be biased to provide various desired levels at the output and even found a way to get it to act as a simple amplifier. But we haven't covered what's really going on with a bipolar transistor—the control of the collector current by changing the base current. In Part II, we'll look at this action and work beta into our analysis of just how this little piece of silicon acts. (Thanks to Richard Herrington for the suggestion for the DAC circuit.)■

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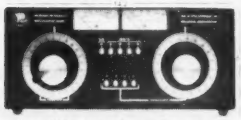

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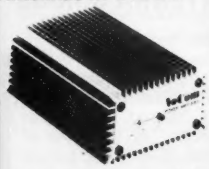

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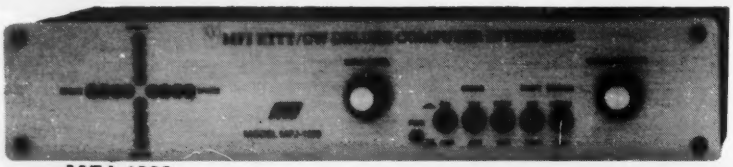

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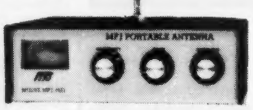

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MFJ/BENCHER KEYER COMBO

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Yikes! Spikes!

You paid good money for that computer system. Now spend a few hours building an insurance policy against voltage spikes.

How many of you computer users are aware of the damage caused by voltage spikes present on the ac line? These little gremlins can scramble programs and destroy sensitive ICs. Commercial filters are available to alleviate these problems, but their cost can often exceed the price of your computer! So if you cringe every time the refrigerator turns on, or if you are unaware that this potential problem even exists, please read on. A little solder and an evening's work will produce a filter that will protect your investment at a fraction of the commercial cost.

Description

This filter will protect your computer from two types of interference: line transients and RFI. Transients have many sources. Inductive loads, such as motors turning on and off, will generate voltage spikes on the ac line. These spikes can be many times higher than the nominal 117 V ac. A nearby lightning strike can also cause a spike. Even turning your printer on or off can create a voltage spike. A subtle result of these transients can be information scrambled in the computer's memory or, more seriously, blown IC chips in your equipment.

To prevent these spikes from damaging devices on the ac line, three metal-oxide varistors (MOVs) are used. This device is a voltage-dependent, symmetrical resistor which acts like back-to-back zener diodes. The MOV normally presents a high impedance across its leads. However, when a voltage spike is present, the impedance of the MOV becomes very low, providing a conducting path for the spike energy. The MOV can handle surges of up to 4500 Amps at 175 volts. An MOV is used across the line and from each leg of the line to ground. This will shunt damaging spikes away from sensitive equipment.

One word of caution is in order here. An MOV that is exposed to an extremely high energy pulse can overheat and shatter. You could protect each MOV with a ten-Amp fuse in series with it, or omit the fuses and house the MOVs in a box to protect yourself in case of this unlikely event. I chose to allow the MOVs to self-destruct in their duty of protecting my equipment. An

This unassuming device could save you thousands of dollars.

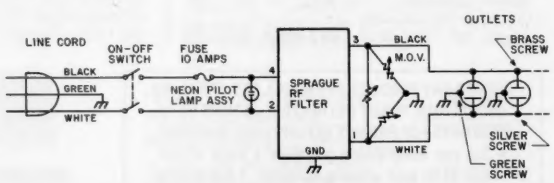
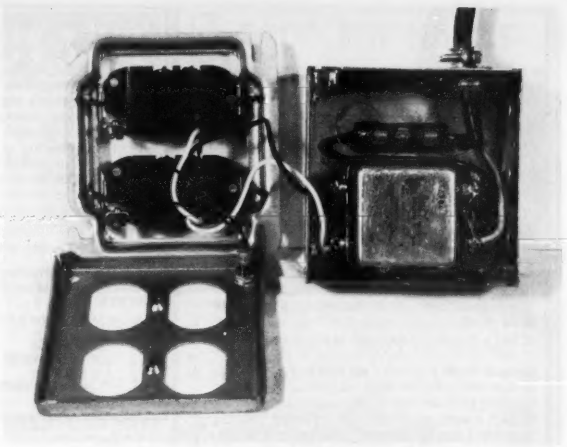


Fig. 1. Schematic diagram of the filter.

Parts List

Metal-oxide varistor	RS 276-570	3 @ $ 1.59
Rf filter, 2 × 12 Amps @ 250 V ac	Sprague JN10-2296A1, from Fair Radio Sales Lima OH	3.95
Line cord	W14-3CG, from Fair Radio Sales	2.00
Pilot lamp assembly	RS 272-707	2.19
DPST switch	RS 275-1546	2.69
10-Amp fuse holder	RS 270-739	.79
4" × 4" × 3" metal box	hardware store	1.69
Box extension ("mud ring")	hardware store	.39
Romex connector	hardware store	.20
Duplex outlets	hardware store	2 @ .39
Outlet cover	hardware store	.99
		$20.44



Inside the filter. The outlets are mounted on the box extension.

MOV is still far cheaper than my computer.

Computers are also affected by radio-frequency interference, or RFI. Rf energy can enter the ac lines from your transceiver, a nearby lightning strike, or your neighbor's CB set. This stray rf can also wreak havoc with computer operation. Likewise, computers generate quite a bit of RFI themselves. This can show up as noise on your receiver or television set. An rf filter takes care of RFI coming *and* going. A commercial rf filter available at a very reasonable price is used. It is rated at 12 Amps, which is well above my modest current draw. In my case, a very poor picture on my monitor was completely cleared up using this device.

Construction

I housed my filter in a 4" × 4" × 3" metal box used in house wiring. A box extension, or "mud ring," is added to the front of the box so that the outlets will clear the rf filter. The filter and the fuse holder are mounted on the bottom of the box using 4-40 hardware. A Romex connector is used as a line-cord strain relief. The MOVs are soldered directly to the rf-filter terminals. The duplex outlets are screwed directly into the box extension. All of these details can be seen in the photographs. Since the filter is capable of handling 12 Amps, number 14 or larger wire should be used throughout.

For the best protection and for safety's sake, the green wire (grounding wire) must be *securely* fastened to the metal box. DO NOT OMIT THIS! If something should happen and a live wire comes in contact with the metal box, the green wire will cause the fuse to blow. Don't let sloppy twelve-volt construction habits leak in. This is 110 volts ac and can be *deadly* if mishandled. Likewise, the ground screws on the outlets and the rf-filter ground should also be securely fastened to the box. If your house still has the older two-wire outlets, I suggest building this filter in a plastic insulated box to eliminate any shock hazard.

Also, pay close attention to the black and white wires of the line cord. Be *absolutely sure* that the proper color wire of the line cord makes it to the appropriate screw of the outlet. The white wire should eventually end up under the silver-colored screw of the outlet. The black wire should end up under the brass-colored screw. Don't get your wires crossed! If you have any doubt, consult your local electrician. Using the schematic, wiring should take but a few minutes.

Checkout and Operation

Using an ohmmeter on the high range, measure the resistance between each of the two pins on the outlet and ground. The reading should be infinite. The reading between the two pins of the outlet should also be infinite. Next, measure the resistance between the ground pin of the outlet and the case. The reading should be zero. Finally, check for continuity between the white wire of the line cord and the silver screw of the outlet. Ditto for the black wire and brass screw. Make sure that these wires are not crossed!

Your computer and disk drives should be plugged into the filter. Your monitor and printer should be plugged directly into the wall outlet. That's all there is to it! Now, when an unannounced spike arrives at your door, simply shrug it off and keep on computing. ■

✓ See List of Advertisers on page 80

GLB PACKET RADIO CONTROLLER

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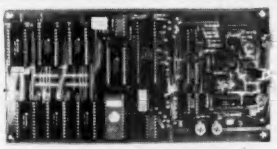

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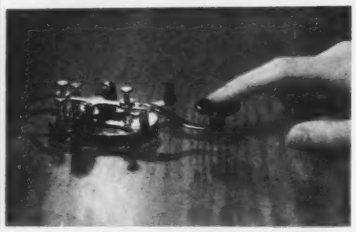

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TS430S FILTERS

You can select 3 optional $60 Fox Tango filters for your TS430S: SSB Narrow (1.8 or 2.1KHz bandwidth), CW Narrow (250 or 400Hz), and AM (6.0KHz). To improve CW or AM reception, you must use one of the filters indicated. For SSB there is a *choice:* you can add one of the narrow filters, or you can use the improved FIlter Cascading Kit.

We recommend the Cascading Kit because it is more effective. It benefits *both* SSB and CW reception without affecting the other modes or TX. When you just add a narrow SSB filter, the mode switch lets you select *either* the stock (2.4KHz) filter *or* the narrow one. Either way, the I-f signal passes through only *one filter* — the other is idle! In the Fox Tango Cascading Kit *two filters are active*: the signal first passes through the stock filter and, near the end of the i-f chain, through a second filter — the high quality 8-pole Fox-Tango 2.1 KHz unit and its amplifier board. Here are the results:

	BEFORE (with Stock SSB)	AFTER (with Cascade Kit)
-30dB Bandwidth	3.2 KHz	2.16KHz
IMD Dynamic Range	83dB	100dB (50KHz Spacing)
Idle Noise (I-F)	0dB (Reference)	-6dB (below reference)

The narrower bandwidth improves selectivity. The greater dynamic range reduces QRM. The reduced noise makes weak-signal reception easier. And, as a bonus, the Shift control works much better. Installation is inboard, instructions are complete, no drilling is required, and only a few soldered connections are needed. However, skill is necessary; your dealer can help if desired.

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FTK-430S CASCADING KIT (including filter, board, instructions, etc.).....$ 85.
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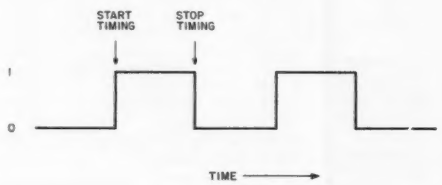
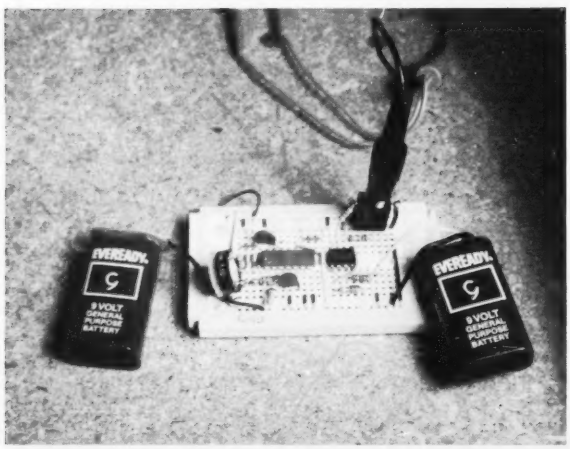


Fig. 1. Square wave.



The completed unit.

Home computers are used for many applications, from balancing checkbooks to defending civilization from the Klingon Empire. All of these programs have a common characteristic: Important data must be included in the program itself or entered from the keyboard. Manual data entry is tedious for long lists of data and impossible for voltages and other analog measurements that occur in real time.

The usual method of entering an analog value into the computer is the analog-to-digital integrated circuit (A/D) which converts a voltage to a digital word that can be read by the computer. This approach has several disadvantages. First, a rather complex integrated circuit is required to do the conversion. Second, the output of the A/D must be passed on to the computer through an 8-bit I/O port, which requires another complex IC. Third, the expansion bus on the computer is tied up with the I/O port and is not available for other applications (such as a RTTY terminal).

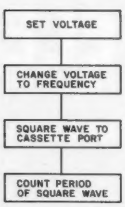


Fig. 2. A/D function flowchart.

The advantages of A/D circuits will be discussed in the conclusion section of this article. The capability for a simple A/D converter can be implemented on the TRS-80™ Model III microcomputer using only two ICs and the cassette port. The remainder of this article will describe the basic approach used and the hardware and software to construct a simple computer voltmeter.

Basic Concept

The cassette port on the Model III TRS-80 microcomputer is available as an input

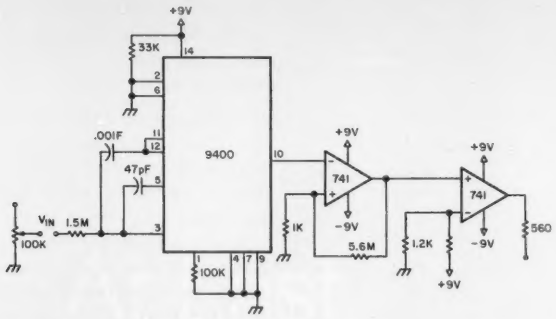


Fig. 3. The circuit performing the voltmeter functions.

```
00100           ORG     65400
00110 PORT      EQU     OFFH
00120 START     XOR     A
00130           LD      HL,0H
00140           IN      A,(PORT)
00150           AND     01H
00160           LD      E,A
00170 STATE1    IN      A,(PORT)
00180           AND     01H
00190           CP      E
00200           JR      Z,STATE1
00210           LD      E,A
00220           XOR     A
00230 STATE2    INC     HL
00240           IN      A,(PORT)
00250           AND     01H
00260           CP      E
00270           JR      Z,STATE2
00280           JP      0A9AH
00290           END
```

Program listing 1.

or output device and can be accessed with the Basic command INP(x) or OUT(x). The data obtained from the cassette port is in binary format, that is, either a 0 or a 1, seemingly not very useful in measuring an analog signal. However, if the signal into the cassette port is a square wave, as illustrated in Fig. 1, then more useful data can be obtained.

If the time that the input port is in the 1 state can be measured, then the period (P) of the square wave (and frequency, since f = 1/P) can be determined. To use the cassette port to measure a voltage, the signal must be changed to a square wave with a frequency that is proportional to the voltage. Fortunately, an integrated circuit exists, the 9400 V/F converter, which is designed specifically for that function. The concept used to implement the A/D function is given in flowchart form in Fig. 2.

Hardware

The circuit that performs the hardware functions of the simple voltmeter is shown in Fig. 3. The heart of the system is the 9400 voltage-to-frequency (V/F) converter. This chip can be wired for a variety of applications including V/F, F/V, a frequency-shift keyer, and more. In this application, the input voltage is converted to current by the input resistor and sent to pin 3. The output at pin 10 is a square wave of about 50 mV. This signal is boosted to approximate TTL (0-5-V) levels by the first section of a dual-741 operational amplifier. The second section is used to produce a waveform symmetrical about zero, which is required by the Model III

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```
10 CLEAR:DIM DA(30),DT(30),DB(30),TX(30),TY(30)
20 FOR I= -136 TO -108: READ X:POKE I,X:NEXTI
30 DATA 175,33,0,0,219,255,230,1,95,219,255,230,1,187
40 DATA 40,249,95,175,35,219,255,230,1,187,40,248,195,154,10
50 DEFUSR1=&HFF78
60 CLS
70 NO=0
80 '
90 '
100 INPUT" ENTER VOLTAGE (-1 TO EXIT)";E
110 IF E=-1 THEN 180
120 NO=NO+1
130 DB(NO)=E
140 GOSUB 310
150 DA(NO)=DA
160 GOTO 100
170 '
180 FOR I=1 TO NO:TX(I)=DB(I):TY(I)=DA(I):NEXTI
190 GOSUB 340
200 '
210 CLS
220 PRINT"POWER CURVE CONSTANTS ARE:  A=";AO;"  B= ";BO
230 INPUT"SET VOLTAGE AND HIT <ENTER>";T$
240 GOSUB 310
250 T1=LOG(DA/AO)/BO: V=EXP(T1)
260 PRINT"VOLTAGE = ";V
270 GOTO 230
280 '
290 '
300 A=USR1(X):RETURN
310 SUM=0:FOR I2= 1 TO 10: GOSUB 300: GOSUB 320: NEXTI2:DA=SUM/10:RETURN
320 SUM=SUM+A:RETURN
330 '
340 '   *** SUBROUTINE TO DO LEAST SQUARES FIT ***
350 '
360 '    DATA IS INPUT AS ARRAY TX() TY() AND NO AS # OF VAL
370 '
380 Z=0:Z1=0:Z2=0:Z3=0
390 FOR IO=1 TO NO
400         Z=Z+ LOG(TX(IO))
410         Z1=Z1+ LOG(TY(IO))
420         Z2=Z2+ (LOG(TX(IO)))[2
430         Z3=Z3+ (LOG(TX(IO)))*(LOG(TY(IO)))
440 NEXTIO
450 '
460 '
470 '       NOW  CALCULATE POWER CURVE CONSTANTS
480 '
490 AO = Z1/NO-(Z*Z3-Z[2*Z1/NO)/(NO*Z2-Z[2)
500 BO = (Z3-Z*Z1/NO)/(Z2-Z[2/NO)
510 AO = EXP(AO)
520 RETURN
```

Program listing 2.

cassette-input circuitry. The 100k-Ohm potentiometer is used to provide an input voltage for testing or offset.

Any construction technique should work as long as neatness and minimum-lead-length guidelines are followed. Two 9-V transistor batteries are used for the power supplies and should provide many hours of operation. One disadvantage of the 9400 IC is that the input voltage and output frequency are related by a power curve. This problem can be solved by using software.

Software

The programs needed to implement the computer voltmeter are straightforward. A short machine-language routine that counts the period of the square wave is given in Program listing 1. The important parts of the program are the two loops, marked by STATE1 and STATE2. The first loop waits until bit 0 of port FF (the cassette port) changes state. The second loop tests the port for the same condition but increments a counter before each test. The final count is passed back to a Basic program using a statement such as A = USR(x).

The Basic Program listing 2 first POKEs the machine-language program into the top of memory (48K machine) and sets the disk Basic USR address. For a 16K non-disk system, the following lines should be changed:

20 FOR I=16351 TO 16380: READX:POKEI,X:NEXTI

50 POKE 16526,223: POKE16527,63

300 A=USR(X):RETURN

Don't forget to protect the upper memory before running the program (use a value of 65400 for the disk version and 16300 for the 16K version).

The relationship between the measured period and the input voltage is nonlinear and follows a power curve, that is, a function of the form: period = a*(voltage)exp(b).

The program starts out by acquiring a number of calibration points. The voltages can be obtained using the potentiometer shown in the circuit diagram. The best results were obtained when calibration voltages were from 0.5 V to 2.5 V in about 0.25-V increments. Line 220 prints the constants on the screen and lines 230 to 270 are used to calculate an unknown input voltage.

Since the V/F relationship is a power curve, voltages at the high and low ends of the 9400's range are not measured as accurately as values in the middle of the range. When input voltages were held to the range mentioned above, measured unknown voltages were within ±10% of the actual values. Input voltages can be kept within those limits by adding a 0.5-V offset voltage to the input (using the potentiometer) and limiting the input to 2.0 V using voltage dividers or operational amplifiers.

Conclusion

By no means is this circuit designed to be a high-accuracy A/D. The main thrust of this article has been to illustrate how an A/D converter can simply and with very little effort be added to a computer system. The nonlinear response of the system limits its accuracy. Traditional A/D converters are linear, provide better accuracy, and can be much faster.

This is not to say that this application is worthless! The number of potential applications is limited only by the imagination. For example, the output of a weather station could be monitored and weather data plotted out. The system also will provide a useful addition to the computerist who wishes to dabble in hardware interfacing. ■

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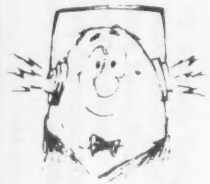

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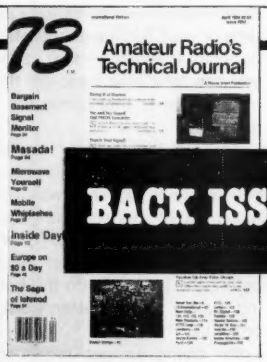

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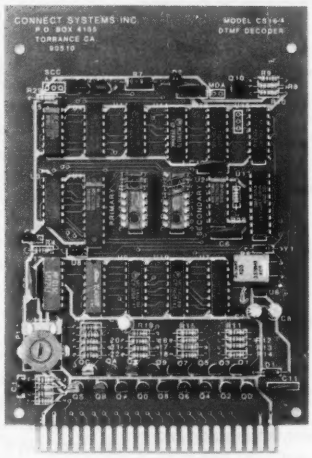

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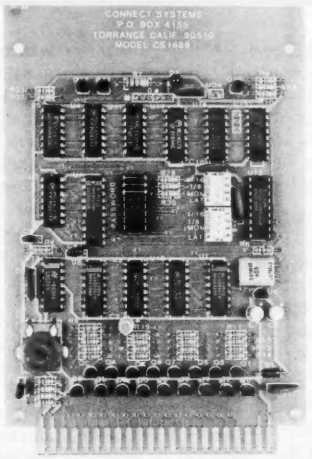

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NEVER SAY DIE
editorial by Wayne Green

from page 4

And remember that with Reagan boss for four more years, we have to live with the mess we've made. And we've made the mess, not the FCC.

The Commissioners were right in their perception of the problem and probably right in their attempt to solve it. They just couldn't conceive that the League could be so blind as to destroy the hobby rather than let it grow.

I've talked with most of the Commissioners at length and what has happened is not the result of any misunderstanding. They understand amateur radio better than most amateurs and my hat is off to them for doing their homework.

They recognize that today amateur radio is no longer providing the services for which it was chartered (see 97.1). They see it, all too clearly, as a small elitist group of aging men, largely retired, who want to preserve their fun and keep newcomers out.

They know our incredible past record of inventing and pioneering new modes of communications, but they also know that this aspect of the hobby died out twenty years ago when the League proposed to take away phone privileges from 85% of the hams.

For twenty years the hobby has lived on its old glory. Now amateur experimenting and pioneering are virtually dead. Indeed, this is the realm of the younger ham, not the old-timer, and we have almost no young hams these days. Just go to a hamfest or a club meeting and you'll see for yourself.

The lack of youth on our bands has helped to develop cliques among the old-timers. Today we hear foul language on our bands that was completely unknown twenty years ago. We hear organized groups of jammers on service nets and repeaters. Indeed, you'll be hard put to find CB anywhere in the country as bad as some of the stuff we hear on our ham bands.

Complaints to the FCC? Make me laugh! They now taunt us with our once proud claim of being the number one self-policing radio service. Old men don't seem to have much fighting spirit, so when another cranky old man gets on the air and louses it up, the first old man just turns his rig off and calls the FCC, only to find they really don't care. Youngsters would get their bile up and make it their business to do something about it.

How many of you reading this can remember when you had pride in being an amateur? We were damned good communicators! We built ham gear and we had a ball. I built my first narrowband FM rig back in 1948 and helped pioneer that new mode. I got fascinated by digital communications then and built my own RTTY equipment. *73* was founded on the basis of helping hams to design and build new equipment—to cope with the changing technology. We were in there first with SSB and then with solid state. What magazine made repeaters happen as a world phenomenon? If you don't know, it was *73*, and with zero help from any other magazine.

Now what do we build? What have *you* built lately? Are *you* on OSCAR? Are *you* on RTTY? Packet radio? Are *you* going to try spread-spectrum?

Sure, there are a few old-timers who have devoted their lives to getting QSL cards from over 300 countries. A fat lot of karma in that! What a waste of a life! That's no more valuable than going to your grave knowing the ratings of all the major-league players. Phooey.

Good karma? There's lots of it around. Just get some youngsters into our dying hobby, that's all. I've been to a couple of ham clubs recently giving talks and they were proud that they had chased all of the kids out. Bunch of old men all agreeing that no one should get a ham ticket without the code, yet most of 'em bitterly oppose any move to check to see if they still remember the code, which many don't.

Can your bunch of old fogies get a ham club started in a local high school? Wait until you hear all the excuses from OMs too busy for that.

No, the Commissioners were right on the beam when they decided that amateur radio had outlived its usefulness. Unless you personally do something which will help to change what is happening, all you are going to see for the next few years is one ham band after another going away.

Put yourself in their seat. Would you squander a public resource worth billions on a bunch of old men who are using it for a useless hobby? Heck, we aren't even a major market for ham gear—most of which is being made in Japan these days. We're just making the balance-of-payments situation worse.

Shall we have a short commemorative prayer for Hallicrafters, Hammarlund, Johnson, Gonset, Central Electronics, Harvey Wells, Webster, Swan, Galaxy, WRL, Sideband Engineers, Eldico, and Lakeshore Industries?

We haven't invented anything in twenty years. We are no longer of value as a source of trained technicians for the military in time of war. Tell me about international friendship—that is, if you can take your hand off the mike button in that pileup for a moment.

You, on the repeater, would you mind telling me again where you are located? That was the high point of your endless transmission and I was dozing off when you mentioned it—just before the jammer with the boring supply of four-letter words broke in.

I'm trying to get high-tech hobby clubs started in high schools. I've donated groups of computers to two local schools and they are both going great guns. High-school ham clubs don't even need equipment—all they need is encouragement and to have local hams come in and teach them the code and theory. They need a weekly meeting and pep talks about the excitement of the hobby. I'm involved in my town; how about you? Too busy?

Oh, I'm working on the national level, too. I'm on the advisory group for Senator Humphrey, I talk with the FCC Commissioners, I talk with Senator Gold-

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water, and so on. How about you? Have you ever visited your Congressman and asked him to help get ham clubs into every high school in your state? Have you discussed this with your governor? I've talked my governor's ear off on the subject, and he's very interested. I've also talked with the governors of Vermont and Maine. How about you? What are *you* doing?

You'll find politicians interested in your ideas. They are so used to pressure groups coming to them demanding government support that someone asking for something which costs nothing is a novelty.

So there you have it. If you'll devote 5% of your hamming time to interesting youngsters, to getting a ham club going in your local school, to talking with your governor, congressmen, and senators, we could have our hobby moving ahead in a couple of years. If you don't, it could easily blow away in the same time.

Do you really think that the major communications firms are not well aware of how weak we are? They can make billions using our channels, so you better believe that this has their attention and that they are willing to spend whatever it takes to get rid of us.

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LETTERS

TV VIEWERS NOT DOERS

This is in response to your July, 1984, editorial on implementing a period of instruction time devoted to a "high-tech hobby club, amateur radio, computer, astronomy, whatever." You are implying that by simply getting our teenagers to participate in high-tech pursuits we could get the good ol' US of A back in step with the Japanese.

I agree with you that we must get our youngsters more interested in a field of science that would contribute to America's technological pool. But you can't expect American kids to get involved on the same level as the Japanese kids—mainly because they have a more effective educational system and American kids are more concerned over spending their time having fun rather than figuring out new ways to implement high-speed digital communications.

How many times have you turned on your TV set just in time to catch a bunch of beach-going teenagers advertising some soda pop, bubble gum, acne medicine, clothing, etc., all having a great time? (Or do you have time to watch the tube?) No wonder the American teenager is what he/she is today, a product of a society that seems to encourage having a good time, all the time. I guess having fun comes with the territory when you live in a prosperous nation. But so do the Japanese; how come they don't have the same problem? What have I been discussing for the last two paragraphs?

I am the trustee of an endangered species—a high-school ham club in the US. We are a newly-born organization, only two semesters old. I put notices in the campus bulletin, which is read every school day, a full semester before our club started, only to have the massive number of six students show up for our first meeting (three of whom stayed on, bless their hearts). We hold our meetings once a week after school for the reasons you mentioned in your editorial, lack of school support and money. I have donated much of my time and money, as well as my backup rig to the school station. I wrote several letters to major manufacturers of ham gear asking for donations of new, old, used, or repairable rigs, only to have one manufacturer reply saying how sorry they were that they couldn't help us. It is no wonder that amateur radio at the high-school level is almost nonexistent. We get no support from the school system or the private sector, and to top it all off the kids just aren't interested.

With that, I wish you better luck than I had in trying to interest our teenagers in a high-tech pursuit.

Erwin G. Vigilia KA6WHM
Trustee, Amateur Radio Club
Mira Mesa High School
San Diego CA

LET'S FIGHT ABUSE

This evening I sat down to talk to my friends on 75 meters. Hoping for a pleasant time with a bunch of nice people, I was shocked by what happened. Some other people felt that we were conducting our QSO on "their" frequency—not an unusual situation. But before we could get anything resolved, we were showered with a torrent of abuse. Our colleagues managed to cover a broad spectrum of bigoted obsessions: easterners (actually we cover about a quarter of the country); the ARRL (about half of us are League members); the FCC (we do have licenses); the aged (we range from 21 to 80); Jews and Catholics (we represent all major groups, including clergy and agnostics); we also include a long list of racial and ethnic groups. We were accused of technical incompetence (actually a number of us are EEs) and general stupidity (several of us have doctoral degrees). And on it went.

Most of us scattered. I stayed on, trying to talk with these people. I hoped that if they met one of us as we are, they might be less likely to attack us as stereotypes. But this was not to be, for they gave me neither a reply nor even a callsign. And not long after, they left. It was as though without us there to abuse, they had no reason to be present themselves.

Of course, I was angry. I get on the air to get away from all this. I work as a psychiatrist in a children's hospital, and I often see abuse, rejection, and hatred. I suppose, as I must sometimes tell my patients, that there is no perfect escape. Still, it hurts. Like most feeling people, when I hear this abuse I become a member of all the groups being demeaned. I wish these bigots could realize how much pain their vitriol causes. Perhaps then, if they still possess some scintilla of humanity, they would desist.

Finally, I was and am concerned. This type of bigotry, which festers in certain segments of our bands, is a disgrace too few of us wish to acknowledge. I wonder what would happen if certain civic or political leaders, say an FCC Commissioner or two, were to overhear these antics. It might be hard for us to convince them that these operations represent only a small portion of us, that they are at variance with our hallowed traditions of fraternity and goodwill.

The real world has become much less acceptant of this garbage, much less willing to look the other way. Likewise, we amateurs, both as individuals and as members of our organizations, must summon the courage to recognize this problem—and to fight it.

William M. Klykylo, MD WA8FOZ
Cincinnati OH

STIRRED UP BY WAYNE

I don't recall ever having written a letter to an editor (or senator or whomever) before. However, as you say in your September, 1984, editorial, you like to move people off dead center. Well, I really don't know if I was on dead center, but you have caused me to do some thinking, which is what you like people to do, Wayne.

Anyway, the editorial speaks to the youth of today and, again, why you think there should be a no-code license. I saw a letter in the July *QST* hitting you again on this subject. Up until your September editorial I have held the opinion that the code should be kept, even though I am one of the ones that has trouble reading the code. I have kept my speed to my license level (Advanced), and although my brain does not seem to convert the code very well to the pencil, I am determined to get that Extra! But you see, Wayne, I now have a ten-year-old son and I have not been able to interest him in radio to any great extent. I have not pushed because I do not want to force an issue and totally lose. He's mildly interested, but at his age I was an avid BCL/SWL begging every Christmas for a "better radio." I finally got a used S-20R after many requests.

You went on talking about why you think the youth of today are not interested in radio, and I think you are right! But, sad to say, I don't have any suggestion either on how to turn even my own son around. My wife and I will do the best we can. We have none of the external problems you mention; it's just the way the youth of today seem to be.

As for the code and the Japanese, I now think maybe we do have need for another class of license for the youth. We also need to have a bit faster processing of the new licenses, as well. Back in 1954 I almost gave up waiting for my first ticket, and with all the computers, one would think the process would have been speeded up in the past 30 years. I don't think there should be any reason to take more than a week to get the first license from the FCC or whomever. I also think that we should have a spot in the HF range for them to get their feet wet—maybe 10 or 15 kHz on 80 meters.

Wayne, I haven't always agreed with your editorials or the way you keep digging up old bones about *CQ*, but I must admit you moved me off dead center. I haven't subscribed to *73* since the mid 70s when prices got out of hand. However, enclosed is $19.95 for my next 13 issues.

Do me a favor, keep the ARRL on their toes but bury the hatchet with *CQ*—it's the first one I got as a new ham, reading Wayne Green, and I still get it; it's a good rag and I enjoy it every month. I also get *Pop Comm* and I enjoy every page of that, also. I don't see them still at your throat (in the mag). But do keep us thinking. I feel Wayne Green is important to the amateur community. 73.

Mark J. Manucy W3GMG exW4FJE
Baltimore MD

DOESN'T MIND MONEY

I like your editorials! Not short, but certainly pointed.

Perhaps other publications of interest to amateurs ought to have a rambling editor; your column certainly allows for some steam-venting.

Anyhow, one point which you have made several times over the years is, I believe, more valid than ever—that is, the dearth of people connected with and participating in the exciting hobby of amateur radio who miss opportunities to turn their hobby into, you guessed it, MONEY!

More and more, amateurs in this country are turning into operators who know very little of the equipment they use—nor are they interested in learning the barest fundamentals of "all this fancy stuff."

'Tain't fancy at all! Same basic ol' circuits which have been around forever simply packaged in new packages. Smaller doodads doing exactly the same job as ever!

I have been a ham since my freshman year in high school (1953) and only recently has this "ignorance principle" turned itself into money.

It dawned on me that (1) there is still a lot of tube equipment still in use, (2) even more "new stuff" is coming on line, and (3) fewer and fewer hams repair anything.

With those astounding ideas in mind, a fairly broad technical education to back me up, and a few bucks invested here and there, I cranked up my money machine!

Gratifying, that, even operating part-time; there is a steady stream of broken things through the door, but it is *very* disturbing that there is little interest shown by hams in learning the technical aspects of their rigs!

I certainly don't *mind* putting their money in my jeans, but whatever happened to the roll-it and fix-it philosophy?

It is easier than ever to build quality equipment: sure the corner electronics-ham-parts place has largely vanished, but dear me, there is a veritable ocean of parts available by mail or from surplus!

Our society (even ham radio) is smack dab in the middle of a technical revolution, and no one seems to be heading for the action!

I may never become filthy rich, but I'm sure having a hell of a lot of fun! (Also forces me to say state-of-the-art!)

Robert Hall W6BSH
San Francisco CA

73 INTERNATIONAL

Each month, 73 brings you ham-radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73 Amateur Radio's Technical Journal, *Pine Street, Peterborough NH 03458, USA, Attn: Perry Donham KK2Y.*

AUSTRALIA

J. E. Joyce VK3YJ
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Altona 3018
Victoria
Australia

HIGHLIGHTS FROM THE YEAR

Following are some of the highlights from over the last year or so with amateur radio in Australia, as stated by Mr. Bruce R. Bathols VK3UV, the 1983 WIA Federal President, in his report on the 1984 Federal Convention:

- The new Radio Communications Act was passed in both houses of Parliament (as of the date of this report, we are still awaiting the Act to be Proclaimed).
- An extra 28% tariff duty was levied on *all* amateur HF transmitting equipment.
- Then, the WIA successfully negotiated a new tariff bylaw to enable the import of HF, VHF, and UHF gear at a levy rate of only 2%.
- With respect to the new tariff bylaw provisions, the WIA has been appointed the overseeing body in determining the validity of transmitting equipment as coming within the scope of the new bylaw.
- The Federal President, Mr. B. R. Bathols VK3UV, and Dr. D. Warlaw VK3ADW attended the NZART Convention in Dunedin, New Zealand, in June, 1983. Our representatives returned with a wealth of information and saw the continuing need for constant liaison to be maintained between the two amateur groups.
- Phone-patch facilities were agreed to by Telecom. On the surface all appeared OK as far as amateur radio was concerned, but in depth there are several anomalies to be overcome. At least the matter has received some attention, and the WIA is continuing negotiations with the relevant authorities.
- *Amateur Radio* magazine continues to maintain its previous high standard; much support has been received from members. *AR* celebrated its 50th anniversary during the month of October, 1983, with a special edition.
- The WIA is fortunate to have had a representative at several meetings of the Standards Association of Australia (SAA) during the year, when matters of concern to the Amateur Service were under discussion.
- As well as the above, the Institute has (a) successfully negotiated for the return of 50.000 to 50.150 MHz to the Amateur Service, as a first step towards the return of the full 50.000-to-52.000-MHz segment; (b) provided input to the DOC for the *Interim Handbook for Operators of Stations in the Amateur Service*. The WIA is monitoring progress of the Radio Communications Act, ensuring involvement in discussions about drafting regulations pertaining to the Amateur Service; (c) obtained acknowledgement from the DOC (who have written to a number of other countries requesting the formalization of further third-party traffic arrangements); (d) secured further privileges for K calls on VHF and above bands, and (e) received acceptance from the DOC for an increase in the frequency of examinations for AOCP, AOLCP, and AONCP. It has been a very busy and successful time!

Membership and Services

- Despite a consistent number of amateurs entering the Service, membership numbers have actually shown a slight percentage decline. The reason for this is not really known, but we can assume that the 1982/3 economic policy has been a large contributing factor.
- Traditionally, we seem to lose about 10 percent of our members at the start of the new financial year. However, as has been the case over previous years, the membership numbers always seem to increase around the middle part of the year. A large portion of those members are, in fact, renewals from the past year.
- At the time of writing this report, however, the renewals are about 15 percent down from the trends for previous years. This is a serious situation, and it requires constant monitoring by the Divisions and Executive Office.
- We must come to grips with communication to our members, particularly the outlying ones.

TOO MANY REQUESTS

I, like other correspondents to "73 International," am receiving many letters due to the great interest in this section of *73*. I have received up to 10 letters per week with requests for information and, with the upsurge in interest in Australia by Americans, most requests are for Australiana-type information, both past and present.

In the words of that immortal song, "I am only a common old working man—and when I get a couple of drinks on a Saturday..." Unfortunately, "working man" means 6 days per week and does not leave much time for chasing up information or requests, let alone those drinks on a Saturday night, and a lot of my drinking money goes on postage because up until now only one out of ten writers bothered to send an SASE. [*Ed. note to correspondents: Try to remember always to enclose IRCs for return postage with request letters sent abroad.*]

Trying to alleviate this problem and satisfy what is apparently a great demand for this type of information on Australia, I will, in the future, if an area I am writing about is of particular historical or present-day interest, try to satisfy the needs of those amateurs who don't have big beams or linears and cannot glean this information for themselves via the medium of amateur radio. Also, I will put a greater emphasis on background information than on some of the more mundane amateur-radio information in that area.

BRAZIL

Carlos Vianna Carneiro PY1CC
Rua Afonso Pena 49, Apt. 701
20270 Rio de Janeiro, RJ
Brazil

LONE BRAZILIAN HAM CROSSES THE ATLANTIC

Having left Luderitz City, Namibia, on the southwest coast of Africa on June 10, 1984, the 28-year-old Brazilian ham Amyr Khan Klink PY2KAQ is trying to cross the Atlantic Ocean alone in his 6-meter rowboat!

Not just any mad adventure, it is a long-planned scientific expedition sponsored by the Brazilian IAT-Companhia de Comercio Exterior (Exterior Trading Company), and was studied to its smallest details. Under the supervision of French radio-navigation specialist Maurice Uguen, who was the same to Willy Roos' "North Western Passage" to the Arctics, to Janusz Kurbiel and his polar expedition, and to the *Williwaw* on its next round-the-pole trip to Antarctica, this fantastic journey is raising tremendous worldwide interest.

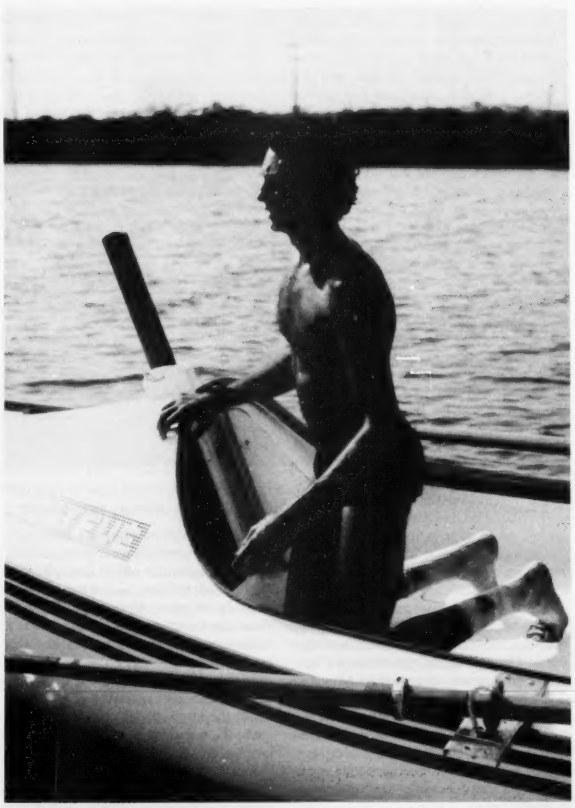
An economist and President-Director to Paraty Investments, S.A., Amyr is an amateur skipper and navigator for high-sea races, a rower for the Esperia Club in Sao Paulo, did Hobie Cat 16 crossings from Paraty to Santos City in 1979 and from Salvador City to Santos in 1980, has sailed from Salvador to Fernando de Noronha Islands and to French Guiana in 1982 for Atlantic Ocean currents studies, and has canoed from P[illegible]ty to Ilha Grande Island and from Santos to Paraty.

This first-time-chosen route, 7000 kilometers long and requiring an estimated three months to cover, allowed for the Benguela, South Equatorial, and Brazil Currents between South Africa and the Brazilian coast—and also the southeastern winds, all aiming at Salvador City in Brazil.

The specially-constructed six-meter rowboat has food and water supplies for a five-month journey. Built of laminated cedar wood by late Alpha, Ltd., Shipyards in Rio de Janeiro, all plans and calculations were made by JCF Engineering, Ltd. It was taken to Ludertiz with everything on board except drinking water.

Absolutely unsinkable due to sealed compartments full of special plastic foam, highly resistant to shocks, with sun-power panels for battery charging, and a complete amateur-radio station aboard for communications, the rowboat, the *Paraty*, has two sealed cockpits and will always be upright. Even if strong waves or wind turns it over, liquid ballast placed under the waterline will right it.

Painted "rescue-yellow" above the waterline with metal radar-reflecting belts, it is painted under water with anti-fouling green and marine blue to avoid ce-



Amyr Khan Klink PY2KAQ at the launching of the Paraty.

taceous attention. Batteries power the HF and VHF communications equipment, lights, navigation, and radar-detecting rigs.

A dehydrated-food program was supplied by Nutrimetal, S.A., under the supervision of technician Flora Lys Spolidoro, with 3800 calories per day being settled on as ideal; vitamins and mineral salts were included. Weekly consumption packages (seven daily-use packages in each) were numbered and subdivided for correct mealtimes so as to discipline meal consumption. Thirty days of extra food was provided for safety.

Physicians and a rowing technician took care of Amyr's physical preparation, check-ups, and evaluations at the Paciornick Hospital. Constant radio contacts with Dr. Edison Mantovani Barbosa, who was responsible for the pharmacy aboard, would provide all the support needed through PY2ARS, Alvaro's amateur-radio station in Sao Paulo.

Alvaro's antenna factory (ARS Electronica Industrial, S.A.) prepared the collapsible HF antenna for 15 and 20 meters with quick-change traps; HF equipment is a Kenwood TS-130; VHF equipment is a Brazilian Control, S.A., HT-type transceiver, 5 channels, and 0.1 or 2.2 Watts output, internal rechargeable battery; two extra battery chargers were supplied, too. Three VHF antennas, one fixed at the cockpit, a second telescoping antenna, and a Heliflex antenna provide this mode.

Together with the 275-liter-capacity tanks for drinking water, a rain-holding device at the cockpit, and two inflatable sun distillers, there was an experimental chemical salt-eliminator using an ion-exchange system (from the US Air Force).

As of now, Amyr has already traveled more than half the way. He keeps in touch with five Brazilian and French stations for weather predictions, information, and family news.

Any problem can be attended to through a parallel system of all equipment aboard. Each piece of equipment is numbered on a control map, so spare parts, repair materials, chemical compounds, medicines, or anything else for any emergency can easily be located. Instructions can be radioed to Amyr, with CW used as an extra backup.

Hand and buttock blisters were the first problems faced by Amyr after days of rowing, but Dr. Edison's attendance quickly stopped them.

Storms with seven- or eight-meter-high waves, sharks, and whales are "part of the show," Amyr says when QSOing.

During good weather, his daily routine includes some 8 or 10 hours of rowing, some rest each two hours, a close-to-8-hour sleeping period inside the cockpit, and the other hours on jobs like navigation, maintenance, radio skeds, kitchen affairs, and so on. During bad weather, when no rowing is possible, boat controlling from inside the sealed cockpit is the job, and a one-week-provisions package is provided in this place in case the second cockpit is too hard to reach.

Daily jobs are all preplanned and must be carefully executed. Some jobs may become quite exciting, like removing coatings and small sea animals from the bottom of the boat—which slow the boat speed and, what's worse, attract fishes and then sharks to eat them. Swimming in the middle of the Atlantic Ocean is not a very pleasant idea, and sharks scratching the boat make for a rather uncomfortable sensation, Amyr says.

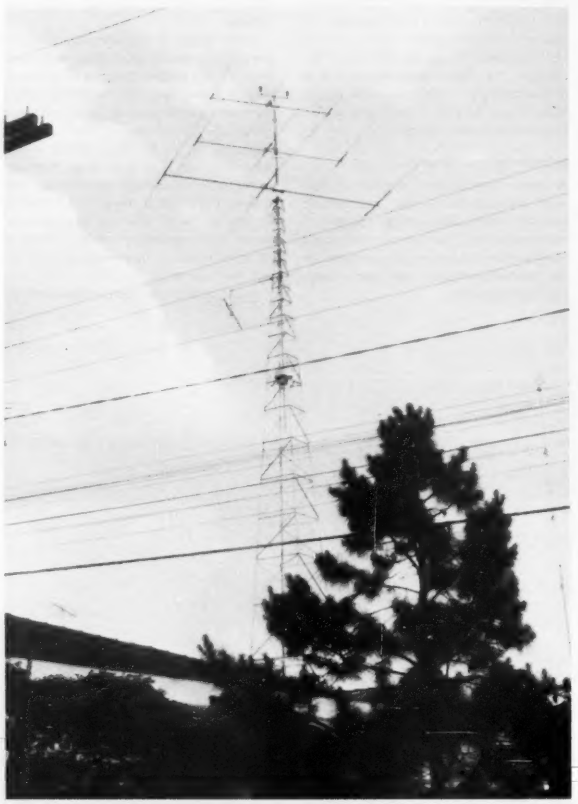
Considering the probable 109-day calculated duration of the journey, and having left Luderitz June 10, Amyr will have reached Salvador City in early October, and although the *Paraty* has already turned over some four or five times, everything is perfectly under control and going according to Maurice Uguen's predictions. The sealed-boat project approved by Maurice is the main cause for this successful expedition, and according to his analysis, Gerard D'Aboville's crossing from Cape Cod to Brest in 1980 and also Tom McLean's crossing, Newfoundland-Ireland in 1969, were also successful due to this fundamental point.

The *Paraty*'s arrival in Salvador will be just a question of time, and contacts through Brazilian Merchant Marine School's amateur station, PY1EMM in Rio, prove the efficiency of the organizer's team, so we're anxiously waiting for October's news, to celebrate this marvelous conquest of the Atlantic Ocean by our Amyr Khan Klink PY2KAQ!

Coordination of promotion data is under the supervision of Editeve Comunicacoes Ltd., in Sao Paulo.

August 30, 1984, note: Just got news Amyr is 1800 kilometers from the Brazilian coast at Bahia, and maybe he'll finish close to 20/30 September.

Amyr and friends getting the feel of Paraty*'s maneuverability. In the background is Sao Paulo City.*



The Christmas-tree beam antennas of Alvaro PY2ARS make QSOs with Amyr an easy and comfortable job.

CZECHOSLOVAKIA

Rudolf Karaba (OK3KFO ARC)
Komenskeho 1477
955 01 Topolcany
Czechoslovakia

CRC, PO Box 68, 113 27 Praha 1, Czechoslovakia, is giving these awards to non-European countries:

● *ZMT* (countries of the peace camp) This is given for contacts with stations in 39 regions according to the following list, irrespective of the bands or modes. The application should be sent to CRC with five IRCs.

OK1	UB	UP	YU
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UA0	UO	YO	

Districts in Y, SP, YO, and YU are differentiated by the last letter in the callsign. Three different numbers in the callsign are required.

All contacts since April 26, 1948, are valid.

● *ZMT 24* The same conditions as the diploma ZMT, but the contacts must be within a 24-hour period.

I have received several letters from the readers of *73* wishing to know about the structure and division of amateur radio's activity in Czechoslovakia.

The license can be obtained by every citizen of Czechoslovakia free of charge if he or she proves to have very good knowledge in operating as well as in technical activity. Or it can be also obtained by a foreign national asking for a license who is a license-holder in his own country. Following prefixes: OK, OL are used for radio hams.

OL is a private class for youths aged 15 to 19. They are permitted to broadcast on the 160-meter band on CW, with input 15 Watts, and on all UHF/VHF bands, CW/SSB also with input 15 Watts. Division of prefixes: OL1 to 7 Bohemia (Moravia); OL8 to 0 Slovakia.

OKs are divided into 4 classes: Class D can work only on the UHF/VHF bands on mode SSB/CW with input 40 Watts. It is not necessary for them to know telegraphy. This class is especially for equipment design engineers.

Class C enables one to work on the UHF/VHF bands on mode CW/SSB and also on shortwave bands in the range of 1750–1950 kHz (CW), 3520–3600 kHz (CW), and 28,100–28,200 kHz (CW). Knowledge of telegraphy *is* necessary.

Class B can work on all bands, on shortwave bands as well as on VHF/UHF, operating all modes with input 150 Watts.

Class A (Extra class) can work on all bands with input 500 Watts by all modes.

Division of prefixes: OK1—Bohemia (Czechoslovakia), OK2—Moravia, OK3—Slovakia, OK4—stations working on ships (sea/rivers), OK5 to 7—special stations, OK8—foreign nationals, OK9—special stations, OK0—repeaters; OK1 to 3 are prefixes of general use.

Radio clubs can be operated by all holders of private callsigns as well as by operators without any private callsigns in the same classes as they were appointed (class A, B, C, D). These can work only in

radio clubs. Class C can be operated by operators who are older than 10 years. They are radio amateur transmitters. Besides that there are hundreds of technical clubs and groups of various technical interests. All the grants concerning accessories and TCVR are free of charge for radio clubs.

GREAT BRITAIN

Jeff Maynard G4EJA
10 Churchfields
Widnes WA8 9RP
Cheshire
England

After an absence of some eighteen months, I have just visited the United States again. This time I notched up my first visit to New York—and found most of the stories of the heat and humidity to be true (thank goodness for air conditioning). Unfortunately, from the tourist's viewpoint, I spent only twelve hours on the ground thanks to the Concorde.

I left London's Heathrow Airport at 1030 and arrived at JFK at 0930 for a full day's work. That same evening I departed JFK on British Airways' overnight 747 back to London. Not a great deal to do with amateur radio you might think—but I did manage to listen to a 2-meter scanner for about 15 minutes and heard something of the frenetic activity in that part of the world.

I had thought of trying to call in on a ham store before heading for JFK, but I realized that prices would no longer be competitive. When I bought my squeeze keyer and Bearcat scanner, the pound was worth $2.40—it is now worth barely half of that amount (around $1.30). It is probably cheaper to buy ham gear in the UK now for US tourists rather than vice versa.

I suppose most readers heard the Los Angeles Olympic Station, NG84O, sometime during the Games. I thought I would like a QSL from that particular station and noted the proposed operational periods of 1600 through 0400 GMT on all bands. That, of course, was a convenient time for European contacts, covering, as it does, the evening hours. However, despite several sessions listening just inside the US phone-band edges, I was unable to make any contact. Conditions do not seem to have been too good on the few occasions recently when I have ventured into the shack. I think I have mentioned previously that summer evenings and weekends tend to be reserved for playing golf. Most of my amateur-radio activity takes place in the winter (not because it's too cold for golf, but because it is too dark!).

Incidentally, you may like to know that a special UK Olympics station was planned to operate from the John F. Kennedy Memorial at Runneymede, near London. I did not listen for this station and do not know if it operated. But any readers with GK0JFK in the log not only worked it but have collected a good one for WPX! QSLs are via G3VIE (do you remember the first special station from Runneymede—WG3JFK?—I never did get my QSL confirmed!).

A glance at the recent issue of *Radio Communication*, the Radio Society of Great Britain's monthly journal, shows a continuing interest in the establishment of special-event stations. Some 15 to 20 such stations are established every month for a few days, each usually coincident with a particular public event or show.

Typical of these events are the Yeovil Festival of Transport (with the station GB2YFT), the Oldham Summer Show (GB2OSS), the Pontadrawe Folk Festival (GB4PFF), and the Pen-y-Fal Hospital Fete (GB2PYF). You will note that all of these special-event stations use GB prefixes—an ideal contribution to the WPX hunter. GB8 prefixes are also available for special-event stations, but operation is then limited to 144 MHz and above (making them an even greater catch for the US OSCAR operator).

The relatively long lead times involved in the preparation of these articles and subsequent publication in *73* preclude me from providing you with dates for special-event stations. However, I can give two dates for any reader planning trips to the UK. The RSGB Annual General Meeting will take place on the 8th of December at the IEE, Savoy Place, London. The RSGB National Convention (and exhibition) is planned for April 13–14, 1985, at the National Exhibition Center, Birmingham. Further details on either event can be obtained from the RSGB at Alma House, Cranbourne Road, Potters Bar, Herts. EN6 3JW, England.

The 1984 RSGB National Convention was again accompanied by the RSGB National HF Convention, which consisted of a series of lectures/discussions on a variety of topics throughout the day. I am much encouraged by reports that the most popular session (during which there was standing room only) was the Home Constructors Forum. This included lectures on PC-board production, test equipment, and construction techniques and was followed by a panel question-and-answer session. Let's hope for a return to home-brew gear rather than black-box purchasing as the norm.

Other topics covered during the convention included DXpeditions (including slides of trips to OJ0, VP8, ZB2, 9L, and OY), amplifiers, and general HF matters. The latter session was chaired by the RSGB's HF Manager, G3FKM, and included other well-known HF exponents on the panel. A good deal of the limited time available was spent discussing the merits or otherwise of the Society's decision not to allow trophy winners to take home their silverware for the coming twelve months!

ISRAEL

Ron Gang 4Z4MK
Kibbutz Urim
Negev Mobile Post Office 85530
Israel

THIRD-PARTY TRAFFIC IN ISRAEL

For radio amateurs in North America, traffic handling is an essential part of the hobby. Indeed, in the US our hobby is known as the Amateur Radio *Service* for this reason. In other countries, where amateur radio is licensed by the same authorities who are responsible for the postal and telephone services, third-party traffic is unheard-of or severely restricted.

In Israel, we are somewhat more fortunate than many of our counterparts in the world. A number of years ago, Mark ZL1BMU stayed at our kibbutz for a few months and was delighted to run many phone patches to the States for members of our community. This task, often routine and rather a chore at times for us here, was a pleasure for him, as phone patching was forbidden in his home country.

Israelis have many relatives living abroad, and often for them amateur radio means a link with them. Thus, for many people here, the message-handling capabilities of ham radio serves as the *raison d'etre* of our hobby. More than one disgruntled neighbor coming to complain about the lines on his television screen, after having received a communication from his cousin overseas, has returned home with a smile on his face—having completely forgotten the TVI.

To date, Israel has third-party-traffic agreements with the following countries: United States, Canada, Great Britain, Austria, Costa Rica, Panama, Switzerland, and Luxembourg. I hope there will be more official agreements and more non-hams will come to better appreciate what we have to offer.

Phone patching, legally speaking, is actually a bit more complicated. According to the licensing regulations of the Ministry of Communications, only the holders of class-A tickets are allowed to let unlicensed persons operate their stations under their direct supervision. Thus, the Ministry says that only this highest-class licensee can let a non-ham speak over his station, and only class-A amateurs may install a phone patch. To further complicate matters, he may not install any old patch, but must have the device approved by the Ministry and pay an additional licensing fee, which is considerably more than the cost of his station license.

Nevertheless, there *are* 4X/4Z stations with phone patches, although relatively speaking they are few. Roughly, only 15% of Israeli hams hold the coveted grade-A license (that allows also the use of high power), and then only a fraction of these have a patch authorization.

In fact, it isn't much of a problem to find stations in North and South America who are willing to patch us through to telephone lines on their side. For many hams this has become routine and there are various nets and skeds that take care of the traffic handling.

The problem begins when stations abroad look for Israeli hams who can run a patch for them. As mentioned above, there are relatively few hams here possessing patches, and since they are scarce and the demand greatly exceeds the supply, they do not—how shall I say it—advertise themselves. A number of years ago, the Ministry of Communications was petitioned to allow grade-B licensees to connect phone patches, but to our dismay the Ministry refused to give in.

One other difficulty, it may be added, is the peculiarity of the Israeli telephone system, which is one of the most expensive in the world to subscribe to. There is no possibility of originating collect calls, so the amateur must dial at his own expense. He does partially get around this by explaining to the party on the other end of the line as briefly as possible what's going on and having him call him back.

When the war in Lebanon broke out in the summer of 1982, the wider Israeli public came to know what an asset amateur radio is to the country. With the outbreak of hostilities, thousands of army reservists suddenly found themselves called up from their civilian roles and in Lebanon with the advancing forces. Those of them who were hams had the presence of mind to pack their two-meter hand-held rigs, and it turned out that with the rapid pace of events, they were the only means through which their fellow soldiers could notify their anxious families that they were alright.

Other gear was put into action on forty-meter SSB, and along with the two northern two-meter repeaters, the airwaves were buzzing with messages day and night. In due time, the Army Communications Corps established means by which the troops could telephone out, happily putting the overworked hams out of business.

The Israel Amateur Radio Club received letters of appreciation from various units of the Israel Defense Forces, and for a while the media was full of stories dealing with amateur radio. Avi 4Z4AB, who handled over a thousand messages, was interviewed daily for a week on one of the local radio stations.

After all this, it was hoped that the Ministry of Communications would relax their regulations on the use of phone patches. No such luck. The only consolation was that none of those allegedly breaking the phone-patching regulations during that period were prosecuted.

There's an interesting side note to this, having nothing to do with the subject of phone patching. An Israeli amateur drafted into the IDF for the war noticed in one town in Lebanon a tribander on one of the houses. He knocked on the door, introduced himself as a ham, and had a very nice visit with the OD5 amateur who, for obvious reasons, will have to remain anonymous. Before leaving, he gave him his address in Tel Aviv and told him he was welcome anytime.

Imagine our friend's surprise when one evening, upon answering his doorbell, he found the Lebanese ham accompanied by two soldiers who had brought him. Many amateurs were invited over that night to meet the guest, and the next day his host took him for a tour of Tel Aviv and Jerusalem. Peace and harmony do not yet prevail completely in our region, unfortunately, but this story shows that amateur radio can form a bridge between people even under difficult times.

LIBERIA

Brother Donard Steffes, C.S.C.
EL2AL/WB8HFY
Brothers of the Holy Cross
St. Patrick High School
PO Box 1005
Monrovia
Republic of Liberia

AMATEUR RADIO IN LIBERIA

I am off the air, and for an amateur this is a sad situation.

There was an incessant tropical rain. There was no air moving and there was no sign of electrical activity in the atmosphere. This situation is quite normal in these parts during the rainy season. The rain just starts and stops—and sometimes it doesn't stop, at least so it seems.

I turned on the 40-meter rig for a scheduled contact with one of the mission stations up country. We said hello and gave each other a signal report. Then I said, "It's raining cats and dogs in Monrovia. Let's get this job done and pull the plug." Well, we did not finish and I did not need to pull the plug. I heard a distant rumble of thunder and my radio went dead. It was a power surge.

These things do happen, and I have been told that here in Liberia these power surges will, momentarily, take the voltage in a 120-volt line to over two hundred. That is bad, but the damaging effect of the surge is compounded by the fact that it is preceded by a dip in voltage that may be well over fifty percent.

When there is electrical activity in the atmosphere in the vicinity, power surges are normal in any electrical-power distribution system. Ac electrical power is a wave phenomenon and, as such, is subject to all the laws of wave motion. Sound waves, water waves, light waves, and any other kind of waves superimpose and add algebraically. Electrical waves do the same, and the results are known as power surges. There is no electrical system that is immune. In countries that have the necessary resources, the community power system has built into it protective circuits which, in case of a severe power surge, open the circuit, shunt off the surge, and reestablish contact. During electrical storms, these momentary power interruptions are common.

Well, in this part of Africa, the power company is still trying to extend its lines to neighboring towns. They are working on the basics and there is no protection for the consumer. After an electrical storm we routinely change light bulbs that are blown.

Amateurs, of course, understand all this and many of them prefer to operate their radios on battery power, using the ac only for charging the battery. This is an effective way to protect a radio from line surges, but when you solve one problem, others arise, and in the last analysis one has to make a choice. There are advantages and disadvantages both ways.

In any case, my radio was in the transmit mode, operating at full power (100 W) when the surge came through the power line. This has to be the period when the circuit is most vulnerable. The radio itself, a TS-120S, was not damaged. The power supply in use at the time, the Astron VS-35M, was showing an output voltage of zero. I checked the four rectifying diodes. They checked out OK. Sparing you all the details, we (I and some other amateurs) concluded that the IC unit was burned out. It is not available here. We studied the circuit and made a list of parts which might need replacement. A kind American amateur whom I have never met in person is gathering these parts and will mail them by air. I would like to write his call letters for everyone to read, but in a sense so doing would be a disservice to all the other amateurs. Amateurs help each other and help others. Since I have been in Africa, I have learned more than ever the truth of that statement. I have thought many times that it would be well to write an article, "The American Amateur Seen From the Outside," or some such title. Probably it would be trite and redundant—maybe not.

However that may be, thanks again to the good American amateur, my TS-120S will be back on the air in a couple of weeks. For my part, I have learned another lesson. The book says, "Unplug the radio when not in use." In the future I will not plug in my radio during one of these tropical squalls.

HAM HELP

About three years ago I built a CMOS digital thermometer out of *Popular Science* magazine. The probe uses a Texas Instruments 6.8k Tm-1/4 sensistor with a positive temperature coefficient. I haven't been able to find this part—can anyone help?

David Shoaf WD4CZW
RL 5 Box 375
Mocksville NC 27028

Just a note to some of the readers concerning "Ham Help." If someone sends you the information you need, please send an acknowledgement back to that person, perhaps including the postage. After all, he or she went out of the way to find and copy the material for you.

I don't know how many people respond to these requests for help, but in April I mailed 78 pages of information to 7 different hams. Only one person, a teacher, returned a note of thanks. In January it was 5 sets of information—with no replies.

I'll still send the stuff out, but I wonder what happened to the spirit of amateur radio?

J.Y. Lem KB6BO
5222 Coringa Drive
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NEW ZEALAND

D. J. (Des) Chapman ZL2VR
459 Kennedy Road
Napier
New Zealand

This month I thought I would try to give *73* readers a brief summary of the economic position in New Zealand at the basic level and relate that to amateur radio. All figures are in New Zealand dollars (which are equal to about $US0.48 each).

The average basic weekly wage for a qualified tradesperson is somewhere in the region of about $210/220 per week, or $10,920/11,440 per year. The tax rate for this group of New Zealanders is 31.5 cents on the dollar, or between $65.10 and $68.20 per week, reducing the take-home pay to $144.90/151.80 per week.

Land tax on real estate owned is somewhere between $500 and $1000 per year, depending on the location of the property. Indirect taxation in the form of a government sales tax is added to about 50% of the goods we consume, and this sales tax is in the region of 20–30% of the wholesale price of the goods. Another comparative price is that of petrol (gasoline), the ZL motorists paying $4.00 per gallon for premium grade (or $0.89 per liter as we buy our gas since going metric).

Those of us interested in amateur radio are amongst the most affected when the cost of our radio equipment is compared to that of some overseas countries, the customs duty and sales tax being an additional burden hams have to put up with to follow our hobby. For instance, an antenna-tuning unit produced by MFJ, retailing in the US at $US139.95, sells retail in ZL for $NZ459.00. (The direct conversion of the US price to New Zealand currency is about $NZ291.00, the difference being made up by customs duty and sales tax.)

The New Zealand prices for a sampling of amateur equipment are as follows:

IC-02A	$450.00 (approx.)
IC-751	$2280 (approx.) with built-in power supply and desk mike
Yaesu FT-One	$4648 complete
TET HB33SP	$598.00

So, as readers can see from the sampling above, there is a difference when comparisons are made, but don't let this mislead you, amateur radio is still flourishing here in ZL despite the high costs involved. There are many proud owners of high-priced rigs, as the survey mentioned later in this column will reveal. The newcomer to amateur radio usually resorts to second-hand equipment for a start and then, when finances allow, graduates to a more modern new or near-new rig which is proudly described in QSOs or eyeballs at club rooms.

BITS 'N' PIECES

The Post Office has announced that there will be changes in the Amateur Operators Exam, effective September, 1984. Whereas previously the exam consisted of a combination of multiple-choice and short-essay-type questions plus the odd circuit to be drawn or commented on and a good knowledge of the Radio Regulations as they are written, the new-style examination will consist of 80 multiple-choice questions with only one correct answer, no circuits or essay-type answers, and the regulations portion will have more emphasis on the candidate's own explanation of the various regulations covering amateur radio. For these written parts of the A. O. Exam, a 50% pass mark is required for the Technician's grade-III license (non-Morse) and, of course, the 12-word-per-minute Morse test for the grade-II license.

Recently, NZART decided to make a membership survey to help the Council in planning for the future. The response to the survey was very gratifying, with over 89% of the survey papers being returned, and that's quite good for any type of poll. (As was expected, a few took umbrage at what they saw as an intrusion into their private business, and others were a little coy when it came to disclosing the true worth of their gear.) The following were the results in the various survey headings:

Age Distribution

Over half of our members (55.7%) are over 50 years of age, and three-quarters are over 40 (see Fig. 1).

Value of Equipment

This section was under two headings, Home-Brew and Commercial. The majority of home-brew equipment (67%) was valued at under $1000, whereas the peak (35%) for commercial equipment came at $3000. At the other end of the scale, only 1.6% of home-brew equipment was valued at $7500, and 1.4% of commercial gear was valued at $10,000 or above (see Fig. 2). Some proudly claimed all home-brew; others equally proudly, all commercial.

Planning Permission for Antennas

This section drew the fewest responses of all. Only 9.7% of those who answered this section have planning permission for their antennae.

TVI, BCI, and Other Interference

24.6% had experienced trouble in this area, and of that number just over half (53.5%) had consulted the Post Office Radio Inspectors, our regulatory controllers.

Financial Membership of a Branch

79.5% of those surveyed belong to Branches of NZART.

Continued on page 81

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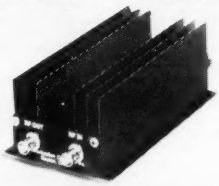

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RS-12A, RS-12M, RS-12S	9	12	4½ × 8 × 9	13
RS-10A	7.5	11	4 × 7½ × 10¼	11
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Thank You for Listening	speech de-compressor	VE1BZJ	Jan 86
A Times Square Data Display	scrolling touchtone decoder	WA4TEM	Dec 8
Top-Band Power Punch	kilowatt amp for 160 meters	WA0VNY	Aug 70
Top-Notch Tuner Time	home-brew antenna tuner	KC2NT	Aug 8
A Useful Present You Can Build	digital kitchen timer	WB4YOD	Nov 58
Watch That Signal!	cheapie signal monitor	W4RNL	Apr 20
Wheeling and Dealing with Preamps	remote preamp switching	W8PMS	Apr 84
Yaesu, Icom Graft Revealed	splice Icom's headset to Yaesu's handie	K2OAW	Aug 32
Yikes! Spikes! Your Own Optoelectronic Anemometer	transient suppressor	W1UO	Dec 40
	intro to optoelectronics	K3VDB	Nov 42
CW			
Ham Over Fist	VIC-20 CW display software	WD8BHH	Nov 64
Painless Op-Amp Filter Design	step-by-step instructions	W4RNL	Apr 102
Random VIC	VIC-20 code practice software	WB7RLX	Jul 66
Sounds Good to Me	VIC-20/C-64 Morse software	W5VKC	Jun 38
The CW Stationmaster	code lover's accessory	W4RNL	Jan 46
Try Quality Code	patches K8TT's Morse keyboard	K6APW	Jun 78
GADGETS			
Breakthrough in Boston	crosslinking interface	W1UKZ	Jan 10
Build the NASA Beeper	simple courtesy beeper for HF	KQ4G	Mar 88
Construct the Minuteman Timer	easy ID timer	KA8QBQ	Feb 14
Don't Grope In the Dark!	emergency lighting system	W7RXV	Jun 16
Here's the Split-Second Timer	audible darkroom timer	WA3REY	Feb 54
Homemade Defroster Shutoff	automatic defogger memory	KB2WM	Nov 68
How to Have a Sunny Field Day	using solar power for FD	W8YZ	Apr 100
Instant Pane Relief	routing cables in and out	KC8UD	Jan 22
Modern-Eyes the S-Meter	add-on signal strength meter	Patterson	Jul 24
Penn's Two-Tone Gadget	dual tone generator	W1BG	Aug 21
Secrets of Cordless Phones	everything you need to know	Haas	Jul 20
Some Alarming Techniques	burglar alarm circuits	WA4CCA	Jan 32
Son of Nicad Conditioner	smart charger for nicads	W1GSL	Jul 36
Thank You for Listening	speech de-compressor	VE1BZJ	Jan 86
A Times Square Data Display	scrolling touchtone decoder	WA4TEM	Dec 8
A Useful Present You Can Build	digital kitchen timer	WB4YOD	Nov 58
Yikes! Spikes! Your Own Optoelectronic Anemometer	transient suppressor	W1UO	Dec 40
	intro to optoelectronics	K3VDB	Nov 42
I/O			
Another Antenna Approach	TS-1000 antenna design	AD1B	Mar 96
The Coniog Solution	Atari contest log	N5ATD	Apr 62
Decode Soviet Space Messages	satellite telemetry decoder	WD0BCI	Nov 53
Give Your Micro the World	A/D conversion for the TRS-80	AI0Z	Dec 44
Ham Over Fist	VIC-20 CW display software	WD8BHH	Nov 64
Picture-Perfect Audio Filters	Apple II filter designer	K3LF	Aug 66
Put the DX World on a Screen	VIC-20 DXing aid	WB7RLX	Feb 69
Random VIC	VIC-20 code practice software	WB7RLX	Jul 66
Ryan's Vertical Ecstasy	CoCo vertical modeler	WB5LLM	Oct 32
Sounds Good to Me	VIC-20/C-64 Morse software	W5VKC	Jun 38
Top Drawer, Micro-Style	Apple drafting software	K3LF	Jan 56
Try Quality Code	patches K8TT's Morse keyboard	K6APW	Jun 78
Yagi Fear?	Atari yagi-design system	W6WTU	May 84
MISCELLANEOUS			
Build a Better Hamfest	tips for successful festing	Housholder	Feb 40
But I Know How to Solder!	basic soldering	WD4S	Nov 28
Doing It at Dayton	preview of the hamvention	WA4BPI	Apr 10
The Edison Effect	Edison first with wireless?	WB2MVK	Jan 90
The End of the Line	coax connector maintenance	WB5LBI	Nov 56
Flying High with Two	ham radio and ultralights	WB8DQT	Jun 20
Grenada Log	ham radio and the invasion	K1XR/N8RK	Jan 20
How to Have a Sunny Field Day	using solar power for FD	W8YZ	Apr 100
In Search of the Shuttle	25 hams tell their story	various	Mar 10
Ishmod's Journal	mysterious trek to Fundy	Whipple	Apr 64
Let's Have More Hams Part I	how to run a Novice class	AD0K	Jul 26
Part II	how to pass the FCC exam	KC3HW	Jul 30
Meeting Erds Make	tips for better club meetings	N6HYK	Jun 30
No-Etch Circuit Boards	cut-and-pry technique	N6JH	Sep 34
Not-So-Famous Garriott Words	Owen speaks	N6BIS	Jun 48
Op Art	using operational amps	KC0EW	Feb 62
The Secret of Remote Control	radio-controlled aircraft	WB3BQO	Feb 18
Secrets of Nicads	the real truth about nicads	WB2FYW	Jan 88
Shoot at Will	Dayton hamfest photo odyssey	KK2Y	Jul 10
Sky Power	contacts via meteor-scatter	WB4CHZ	Mar 90
Stare-Way to Heaven	visit the Arecibo observatory	AJ0N	Aug 33
Take a Trip to Europe	European shortwave stations	Peterson	Apr 48
The Tops of the Palm Trees	DXpedition to Mellish reef	VK2BJL	May 28
Wet Battery Quiz	do you know everything?	VE3AZX	Mar 92
When Darkness Calls	160-meter grayline prediction	VE7BS	Oct 66
MOBILE			
Control Your Mobile Power	reliable power for mobiles	KB5QZ	May 56
Flying High with Two	ham radio and ultralights	WB8DQT	Jun 20
Four Bands, One Whip	four-band mobile antenna	K3OF	Apr 56
On the Move With 10 FM!	quick mods for Comtronix FM80	W7AR	Jan 84
Trade Secrets of Mobile Installation	the right way to mobile-mount	K4TWJ	Jan 64

ARTICLE	DESCRIPTION	AUTHOR	ISSUE
MODIFICATIONS			
Better the R-70	modify the ICOM receiver	KE4AQ	Jun 54
Calculate Your FT-101	digital display and counter	VK8DE	Feb 22
Convert the Oddball			
Easy FSK for the IC-730	add what the factory forgot	WA4TTO	Sep 48
Hy-Gain Boards	CB boards move to 10 meters	N2DS	Feb 77
Messing with Heath	external vfo for the HW-101	AI7C	Aug 46
New Orders for the R-109	low-cost surplus mods	K8AXH	Jun 70
On the Move with 10 FM!	quick mods for Comtronix FM80	W7AR	Jan 84
Quick Qwip Conversion Fax	restore surplus fax gear	KA9GDL	Sep 28
Watch a Warhorse Work	10 and 160 for the SB-221	W3JIP	Jul 48
NEW PRODUCTS			
A5 ATV Magazine	Hamfest! game		Jun 91
Advanced Computer Control	ShackMaster		Jul 81
AEA	Doctor DX		Nov 76
AEA	MBA/Text		Jan 110
AEA	PKT-1 packet controller		Sep 85
Alpha-Delta	Surge Protector		Oct 100
Amateur Wholesale Elec.	EXL-5000		May 109
BHC	Big Ham Clock		Jan 110
Bird Electronic Corp.	4030 field-strength element		Aug 104
Break Communications	equipment console		Mar 109
Buccaneer	sealed connectors		May 109
Bullseye	FrameMaker clamps		Oct 100
BV Engineering	engineering software		Sep 86
Caywood	solid-state dip meter		Mar 109
CES	510SA simplex autopatch		May 109
CMC Communications	voice-operated squelch		Sep 86
ColoRadio Research	900B RTTY/ASCII/CW terminal		Jul 80
Com-Rad	Untenna		Jun 90
Connect Systems	CS-16 touchtone decoder		Jul 81
ContactEast	1984 catalog		Jun 91
Crumtronics	Contender		Jul 80
Cushcraft	AOP-1		Oct 100
Cynwyn	HF antenna design software		Jul 81
Davle Tech	SA-4 desoldering station		Sep 86
Design Electronics Ohio	QSK 1500		Aug 102
Doppler Systems	direction-finding gear		Dec 65
Electronic Specialists	interference protection		Jun 91
Fiesher	TU-1200 RTTY TU		Apr 117
Gilfer Assoc.	Guide to RTTY Frequencies		Jan 111
H. Stewart Designs	DX Hidden Asset antenna		Jan 110
HAL Communications	AMTOR-10A		Dec 65
HAL Communications	PCI-2000 IBM RTTY interface		Nov 76
Ham Industries, Inc.	PA-25 2-meter amp		Jan 111
Hamtronics	COR-3		Dec 66
Hamtronics	GaAsFET preamp		Jun 90
Hamtronics	outdoor scanner antenna		Oct 100
Hamtronics	1984 catalog		Apr 116
Heathkit	HD-3006		Dec 65
Heathkit	HD-8999 keyboard		Aug 104
Heil, Ltd.	EQ300		Mar 108
ICOM	IC-HS10 headset		Mar 108
ICOM	IC-02AT		May 109
ICOM	IC-27H		Oct 100
ICOM	IC-37A		Jul 80
ICOM	IC-471H		Sep 86
Info-Tech	M-44 AMTOR converter		Sep 85
International Crystal	FOT-12 alignment oscillator		Mar 109
ISS	Halon extinguishers		Nov 77
J.L. Industries	Ham-Antuner		Oct 100
Jensen	1984 catalog		Nov 76
John Vesty Co.	VIC-20 Hamware		Jun 90
Kikusui	5060 60-MHz oscilloscope		Jul 80
Larsen	CM-series cellular antennas		Jun 90
Larsen	NMO antennas		Oct 100
Lowrance Electronics	System 70		Feb 86
MCM Electronics	1984 catalog		Aug 104
MCM Electronics	Tenma DMM/DCM		Jun 91
MEC	Unimec modular switches		Apr 116
MFJ	MFJ-407 keyer		Dec 64
MFJ	MFJ-1423		Mar 109
Micro Logic	design reference card		Dec 66
Microperipheral Corp.	modem jack		Oct 100
Microtec	50DC1235 dc-to-dc converter		Jan 111
Moler Antenna	E-field displacement antenna		Jul 80
Mouser	dip relays		Dec 64
Nady	EasyTalk		Dec 65
NCG	7-21-50 transceiver		Jul 81
Nemal Electronics	TVRO control cable		Jan 110
P.C. Electronics	TC-1 Plus ATV downconverter		Feb 86
Palomar	FL-4 audio filter		Nov 77
Rabbitt Ware, Inc.	Tutorcode		Mar 109
Radio School	code and theory tapes		Sep 86
Regency	MX-5000 scanner		Sep 85
Regency	Z10 scanner		Apr 116
Robot	1200C SSTV scan converter		Nov 77
S.E. Corp.	eZ Board prototyping system		Jun 91
SEA	1612 antenna coupler		Apr 117
Simpson	1984 catalog		Nov 77
Smith Software	antenna design software		Oct 100
Software Protection	Copyrighter		Feb 86
Spectrum Communications	SCR2000X repeater		Nov 76
Spectrum Communications	TTC300 DTMF controller		Aug 102
Spectrum Projects	Voice Pak		Sep 86
TAU	SPC-3000 ATU		Dec 64
Telex/Hy-Gain	Ham-SP rotator		Mar 108
Telex/Hy-Gain	hot line		Aug 104
Telex/Hy-Gain	ProCom 352-IC headset		May 109
Ten-Tec	Century/22		Aug 102
Universal Electronics	RTTY Today		Apr 118
Wahl Clipper	Oryx soldering system		Apr 117
Yaesu	FT-757GX		Mar 108
POWER SUPPLIES			
Cheap Power Ploy	12 V 20 A supply	K9QLL	Aug 10
Control Your Mobile Power	reliable mobile power	KB5QZ	May 56
Me and My Stupid Old			
PMOS Converter	get -12 V from +5 V	WB1HKU	Apr 14
Wet Battery Quiz	do you know everything?	VE3AZX	Mar 92
RECEIVING			
Better the R-70	modify the ICOM receiver	KE4AQ	Jun 54
Crystal Microwave	microwave crystal receiver	WA4WDL	Apr 42
Modern-Eyes the S-Meter	add-on signal strength meter	Patterson	Jul 24
New Orders for the R-109	low-cost surplus mods	K8AXH	Jun 70
Painless Op-Amp Filter			
Design	step-by-step instructions	W4RNL	Apr 102
Take a Trip to Europe	European shortwave stations	Peterson	Apr 48
Wheeling and Dealing			
with Preamps	remote preamp switching	W8PMS	Apr 84
REPEATERS			
A Times Square Data			
Display	scrolling touchtone decoder	WA4TEM	Dec 8
Breakthrough in Boston	crosslinking interface	W1UKZ	Jan 10
Piggy-Bank Repeater			
Project	simple repeater controller	KT2B	Jun 42
Sound Off!	repeater beeper indicates		
	received signal strength	K3JML	Jan 28
Strictly for FM Deviates	deviation meter for VHF	KA8OBL	Feb 36
REVIEWS			
AEA	CP-1 Computer Patch		Sep 84
AEA	MBA/Text		Aug 100
AEA	Doctor DX		Oct 82
B&W	AC1.8-30 antenna		Mar 102
B&W	AP-10 portable antenna		Oct 84
Base2 Systems	MUFPLOT		Sep 82
Bash Educational Services	Novice class syudy guide		Apr 129
Belden	9913 coax		Dec 68
Bencher	ST-2 paddles		Feb 92
Bilal	Isotron 40		Oct 83
Break Communications	equipment console		Nov 77
DX Enterprises	DX-1 propagation system		Sep 84
H. Stewart Designs	DX Hidden Asset antenna		Feb 92
Heathkit	SS-9000 transceiver		Jan 107
ICOM	IC-RP3010 70-cm repeater		Jul 82
ICOM	IC-271A		Sep 82
ICOM	IC-37A		Dec 66
ICOM	IC-751		Aug 101
Idiom Press	The Complete DXer		Apr 129
J.C. Labs	Action Monitor		Jan 108
Kantronics	AMTORSoft		Aug 100
Kantronics	Interface II		Nov 81
Kantronics	Introduction to AMTOR		Jan 108
Kenwood	TR-2500		Aug 101
Kenwood	TW-4000A		Jun 92
Mizuho	MX-6Z 6-meter hand-held		Nov 78
NCG	7-21-50 transceiver		Dec 67
N2NY	HamMaster tapes		May 117
Rawn Company	Plast-i-Pair		Mar 102
Regency	Z30 scanner		Jun 93
Santec	ST-144/uP hand-held		Jul 82
Sybex	Astronomy on Your Computer		Aug 101
Ten-Tec	4229 Antenna Tuner		Oct 81
TET	V/UHF discone antenna		Jan 108
Thompson Software	Morse-code translator		Jun 92
Yaesu	FT-726R		Nov 80
Yaesu	FT-980		Feb 90
RTTY			
AMTOR How-To	guidelines for operation	W2JUP	Aug 62
Easy FSK for the IC-730	add what the factory forgot	WA4TTO	Sep 48
Join the Packet-Radio			
Revolution - Part III	protocols and procedures	WA7GXD	Jan 36
Ntty Grtty RTTY	complete Sinclair RTTY	WB6GTM	Sep 38
Rampant RTTY	multi-speed dual-shift mailbox	KOWVN	Nov 50
The Terminal Terminal			
Unit	variable-shift TU	K3PUR	Apr 70
SSTV			
Color Computer SSTV			
Part I	complete color SSTV system	K6AEP/WB8DQT	Nov 10
Part II	adding FAX to the board	K6AEP/WB8DQT	Dec 18
Peak Your Picture with			
Home-Brew SSTV Gear	gray scale and color bars	Cikas	Feb 60
TEST GEAR			
Around and Around			
and Around	Q-meter for coil winders	N7APE	Jan 70
Calculate Your FT-101	digital display and counter	VK8DE	Feb 22
Creason's Do-It DVM	single-IC digital voltmeter	K6EW	Jun 26
Easy Berardi Building	.5 to 600 MHz counter	Berardi	Jun 10
Find Fault with Your			
Coax	time-domain reflectometry	K4IPV	Oct 10
Peak Your Picture with			
Homemade SSTV Gear	gray scale and color bars	Cikas	Feb 60
Penn's Two-Tone Gadget	dual tone generator	W1BG	Aug 21
Rx for Ailing Antennas	build a noise bridge	K4IPV	Oct 28
Strictly for FM Deviates	deviation meter for VHF	KA8OBL	Feb 36
Take the Two-Tone			
Challenge	two-tone generator for SSB	W8DCC	Mar 84
Tester Project: England			
'84	multi-use transistor tester	Penfold	Jun 34

ARTICLE	DESCRIPTION	AUTHOR	ISSUE
Watch That Signal!	simple signal monitor	W4RNL	Apr 20
THEORY			
Around and Around and Around	Q-meter for coil winders	N7APE	Jan 70
But I Know How to Solder!	basic soldering	WD4S	Nov 28
Counter-Productive Basics Part I	digital design fundamentals	K4IPV	Aug 40
Part II	problems in counter design	K4IPV	Sep 8
Digital Design: How to Interface ICs	connecting to the real world	K4IPV	Apr 30
Find Fault with Your Coax	time-domain reflectometry	K4IPV	Oct 10
Give Your Micro the World	A/D conversion for the TRS-80	AIOZ	Dec 44
Join the Packet Radio Revolution	protocols and procedures	WA7GXD	Jan 36
LEDs You've Never Seen	how they work	W5LFM	Mar 58
Op Art	using operational amplifiers	KC0EW	Feb 62
Perfboard and Soldertail?	pc board construction tips	W4RNL	Jul 42
Secrets of Nicads	the real truth about nicads	WB2FYW	Jan 88
Simple Parabolic Theory	dish design basics	OA4KO/YV5	May 52
Transistors: A Biased Approach - Part I	basic transistor theory	KC0EW	Dec 34
Try Low and Behold	are low antennas best?	W1GV	Oct 38
Wet Battery Quiz	do you know everything?	VE3AZX	Mar 92
When Darkness Calls	160-meter grayline prediction	VE7BS	Oct 66
Your Own Optoelectronic Anemometer	intro to optoelectronics	K3VDB	Nov 42

ARTICLE	DESCRIPTION	AUTHOR	ISSUE
TRANSMITTING			
Build the NASA Beeper	simple courtesy beeper for HF	KQ4G	Mar 88
Convert the Oddball Hy-Gain Board	CB boards move to 10 meters	N2DS	Feb 77
Top-Band Power Punch	kilowatt amp for 160 meters	WA0VNY	Aug 70
Watch a Warhorse Work	10 and 160 for the SB-221	W3JIP	Jul 48
VHF/UHF			
Another Eggbeater	two-meter omni	WD5DNL	Oct 48
Crystal Microwave	microwave crystal receiver	WA4WDL	Apr 42
Disco Duckie?	HT headphones	N6CSI	Sep 36
Elementary, My Dear: Watts 'n' Swr	stripline V/UFH wattmeter	KT2B	Sep 14
How to Gain with PVC	world's cheapest 2-m quad	WB6BHI	May 37
Perfect Timing	multi-use repeater ID	VE2DWG	Sep 22
Piggy-Bank Repeater Project	simple repeater controller	KT2B	Jun 42
Simple Parabolic Theory	dish design basics	OA4KO/YV5	May 52
Sky Power	contacts via meteor-scatter	WB4CHZ	Mar 90
Stare-Way to Heaven	visit the Arecibo observatory	AJ0N	
The Big-Car Break-Down Beam	two-meter fold-down beam	N3BEK	May 46
Throw in TV	build a UHF helix	WA4WDL	May 64
Wheeling and Dealing with Preamps	remote preamp switching	W8PMS	Apr 84

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared postcards and odd-sized scraps of paper. Please type or print your request (neatly!), double spaced, on an 8½" × 11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye." and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

I am a handicapped ham and would greatly appreciate any working equipment anyone would be willing to donate to set up a station. I have multiple sclerosis and have been taken off work so I have no money for ham equipment. Anything you send will be so greatly appreciated.

J. T. Statham KA5UKP
1506 Sheila Dr.
McComb MS 39648
(601)-684-9558

I need a replacement power transformer for an NCX-A power supply or the name of a transformer rewinder.

Joseph Karr KA5RKD
RR1, Box 579
Lakeview AR 72642

I would like to get in touch with someone who would be interested in setting up a repeater in Wisconsin Dells or the immediate vicinity. The repeater would not only be nice for hams who go there yearly, but also for hams traveling through the area.

Klaus Spies WB9YBM
8502 N. Oketo Ave.
Niles IL 60648

I have a Commodore PET 2001 and would like to hear from persons who have information regarding C-64/VIC-20 compatibility or who have a user's manual.

Dale Warner
815 Hwy. 190
Mandeville LA 70448
(504)-626-5801

I need information on how to improve the performance of the Drake R4-B, T4-X, and AC-4.

Walter Pereira da Costa, Jr. PY4ZO
Rua Daniel Xavier 414
PO Box 207
Araquari-MG Brazil 38440

I am looking for a schematic for a Sears Roadtalker-40 SSB/AM CB radio, model 663.38100050, for conversion to the ten-meter band. I will gladly refund copying charges and postage.

Bill Springer KC9YJ
4014 N. Grant St.
Westmont IL 60559

I have a 23-channel Midland 13-882C Citizens Band radio. I would like to convert it to a 15-meter CW rig, but I have no idea how to do this. Can anyone help?

Lawrence R. Barley, Jr. KA4ROY
1427 Byron Ave.
Ypsilanti MI 48197

I would like a schematic and service information for a Hewlett-Packard model HP-130B oscilloscope. I will gladly pay copying charges and postage.

Bill Springer KC9YJ
4014 N. Grant St.
Westmont IL 60559

I am seeking technical assistance in modifying the TX/RX switching speed of a Yaesu FT-101ZD for use on AMTOR.

Daniel Murray WA7YIC
1541 Oxbow Circle RR #11
Billings MT 59101

NEW PRODUCTS

MFJ-407 DELUXE ELECTRONIC KEYER

MFJ Enterprises, Inc., introduces the MFJ-407 Deluxe Electronic Keyer to its line of amateur-radio products. The MFJ-407 features iambic operation with squeeze-key, dot-dash insertion, and semiautomatic operation that provides automatic dots and manual dashes. The keyer also features a dot-dash memory, self-completing dots and dashes, jam-proof spacing, and instant-start keying.

Solid-state keying is provided for use with tube or solid-state transmitters. Front-panel controls include linear speed, weight, tone, and volume controls as well as on/off, tune, and semiautomatic switches.

Weight control allows you to adjust the dot-dash space ratio, thus making your signal distinctive to penetrate QRM. A tune switch keys the transmitter for tuning.

The MFJ-407 is rf-proof, has a built-in speaker, and uses a 9-volt battery (not included) or 110 V ac with an ac adapter (MFJ-1305.) The keyer comes in an attractive black aluminum cabinet with a black front plate. The unit measures 7 × 2 × 6 inches.

For more information, write *MFJ Enterprises, Inc., PO Box 494, Mississippi State MS 39762.* Reader Service number 480.

MFJ's electronic keyer.

MOUSER RELAYS

Mouser Electronics announces its entry into the relay market with a quality line of DIP reed relays, the ME431-2000 series. Their DIP-style packaging makes them completely compatible with in-line ICs, and the terminal patterns mate with standard 14-pin DIP sockets. They feature a stable transfer of low signal levels that minimizes interface buffering.

The relays are available in three standard contact forms—1A, 2A, and 1C. Their contacts are rated at 4 or 10 W, with switching currents of 0.3 or 0.5 A and a switching voltage of 30 or 100 V dc. They feature a minimum insulation resistance of 10^{10} Ohms and a maximum operation/release time of 1.0 ms.

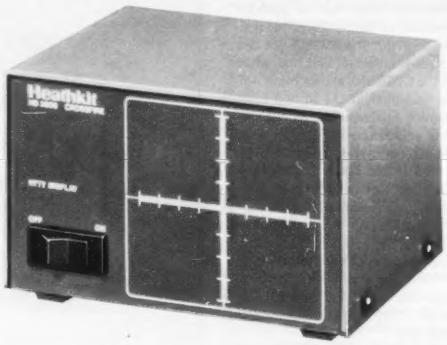
For further details and for a free catalog, write or call *Mouser Electronics, 11433 Woodside Ave., Santee CA 92076; (619)-449-2222.* Reader Service number 476.

TAU SPC-3000 ATU

TAU Systems, Ltd., has announced a new addition to their line of antenna-matching units. The SPC-3000 ATU uses an infinitely-variable roller inductor and 5-kV air-dielectric capacitors arranged in an SPC configuration. A built-in 4:1 balun, rated at 1 kW, is also included.

The front panel sports a counter for the roller inductor, a five-position antenna switch, and two meters—one monitors forward power, the other swr. The unit will

The Tau SPC-3000 ATU.



Heath's RTTY tuning aid.

operate continuously from 1.5 to 29.350 MHz, and is rated for full legal-limit power.

For further details on the SPC-3000 or TAU's complete line of parts and kits, contact *TAU Systems, Ltd., 51 Greenhey Place, East Gillibrands, Skelmersdale WN8 92A, England.* Reader Service number 482.

DIRECTION-FINDING EQUIPMENT FROM DOPPLER

Doppler Systems' latest line of radio-direction-finding units operates with any narrow-band FM receiver in the 27–500-MHz range to provide fast location of interfering signals. No receiver modifications are required—the direction finder connects to the receiver's antenna and external-speaker jacks.

Four economical models are available which provide a range of optional display and remote-output features: a 16-LED compass rose, a 3-digit bearing in degrees, an RS-232C output, and a synthesized voice output. The speech synthesizer is designed for mobile use, as it eliminates the need for the driver to watch the display.

The system operates by continuously summing the outputs of four antennas, simulating the motion of a single rotating antenna. As the simulated antenna moves toward the rf source, an increase in the apparent signal frequency occurs, and as the antenna moves away from the source, this frequency decreases. The up/down (Doppler) frequency shift is detected by the FM receiver and is present as a 300-Hz tone on the audio output. The phase of the tone is measured and used to compute the bearing without affecting the normal operation of the receiver.

For more information, contact *Doppler Systems, 5540 E. Charter Oak, Scottsdale AZ 85254; (602)-998-1151.* Reader Service number 477.

HEATHKIT RTTY TUNING AID

The new HD-3006 Crossfire Tuning indicator is a visual tuning indicator for radio-teletype (RTTY) communication. Sixteen LEDs make up the display: Eight vertical LEDs identify mark signal strength while eight horizontal LEDs do the same for space signal strength. Tuning the indicator for maximum vertical and horizontal display will provide a strong signal for computers or RTTY printers. Each LED bar requires approximately 14 dB no-signal-to-signal voltage ratio for full operation. Minimum input signal is 0.3 V ac rms or 0.5 V dc. Maximum signal is 15 V ac rms or 15 V dc.

The HD-3006 has a wide voltage range and is compatible with almost any interface/terminal unit that has oscilloscope outputs for tuning. The ac/dc cube-type power supply is included in the kit.

To receive a copy of Heathkit's free catalog, write *Heath Company, Dept. 150-435, Benton Harbor MI 49022.* Reader Service number 483.

EASYTALK BY NADY

Nady Systems' EasyTalk™ personal radio communicators are ideal for outdoor activities when close contact with a partner or group is desirable. EasyTalk communicators are lightweight, rugged, and easy to operate. The units are voice-triggered so the user's hands are free. Range is up to ½ mile in optimum conditions.

EasyTalk operates in the 49-MHz FM band. No license is required for use. Model PRC-1X is a clip-on bodypack transceiver with attached headset. The PRC-1X works in the simplex mode—any number of units on the same channel can be used in an area, with users speaking one at a time. Transmission is voice-activated (VOX) or push-to-talk (PTT), with a PTT button on the bodypack. An optional remote-PTT button on a one-meter cable is available.

Model PRC-3X features full-duplex operation—two users can converse simultaneously, as they would on a telephone. The unit is also a clip-on bodypack with headset.

Nady EasyTalk communicators incorporate the latest advances in integrated-circuit technology. The receiver is a highly sensitive dual-conversion superheterodyne for clean, noise-free reception. Headphone volume is adjustable, and the microphone is a unidirectional, noise-cancelling type allowing voice-triggered use in high-noise environments. The microphone is mounted on a flexible boom which holds its position for individual users. Additional features include a call feature to save batteries and a flashing LED indicator to warn of low battery level.

For more information, contact *Nady Systems, Inc., 1145 65th Street, Oakland CA 94608; (415) 652-7632.* Reader Service number 481.

EasyTalk, from Nady Systems.

AMTOR-10A FROM HAL

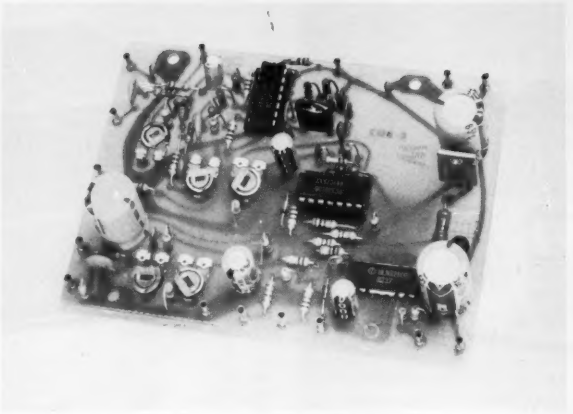
Hal's new AMTOR-10A allows transmission and reception of radio-teleprinter sig-

Doppler Systems' DF unit.

The Hal AMTOR-10A.

nals with the added feature of error correction. The ITU 7-unit code is used for error correction as defined by CCIR Recommendation 476-2. The AMTOR-10A is a code- and speed-converter unit that, when used with the CWR6850, allows 7-unit AMTOR code communications at 100 baud while retaining communications capability with the standard 5-unit Baudot code from 20 to 100 baud, and the 8-unit ASCII code from 75 to 200 baud. The AMTOR-10A is designed to easily interface with the CWR6850 while retaining all of the standard features of the unit, including CW capability. Modes and functions are selected from the keyboard of the CWR6850.

For additional details, write or call *Hal Communications Corp., PO Box 365, Urbana IL 61801; (217)-367-7373.* Reader Service number 479.



The COR-3 from Hamtronics.

HAMTRONICS COR-3

Hamtronics®, Inc., has announced the availability of a new version of their popular COR module, called the COR-3. Like the COR-2 module, the new COR-3 has all the circuitry needed to control a transmitter and receiver to make a repeater: an electronic relay to switch the transmitter on and off as a function of the receiver squelch, a tail timer, a time-out timer, an audio mixer, and a local-speaker amplifier. The COR-3 also has an added courtesy-beep function, including an additional timer which allows the beep delay to be adjusted to up to five seconds after the receiver squelch drops.

Whenever a station using the repeater releases his microphone, a beep tone is heard on the repeater after a short delay period. The beep indicates that the party has finished talking and the time-out timer is reset. The adjustable delay, which is in addition to the normal carrier tail, eliminates talk-over by encouraging users to wait for breakers before picking up the conversation.

For more information on this module and other transmitter, receiver, and control modules for building repeaters, or for a free copy of Hamtronics' new catalog, write to *Hamtronics, Inc., 65F Moul Road, Hilton NY 14468-9353; (716)-392-9430.* Reader Service number 478.

HANDY REFERENCE CARD FROM MICRO LOGIC

If you design or repair electronic circuits, you can now get a handy plastic reference card that lets you get right to the basic workings of everything from op amps to programmable unijunction transistors without having to go through theory, fabrication methods, or advanced terminology. From Micro Logic Corp. of Hackensack NJ, Micro-Chart #10, entitled "Active Electronic Components," is a two-sided 8-½"-by-11" plastic card that is packed with information.

Non-digital functions readily available in a single monolithic package are covered, including 13 diode types, 6 types of transistors, 5 families of thyristors, 4 types of light emitters, 9 types of light receivers, analog switches, A/D and D/A converters, comparators, multipliers, one-shots, op amps, opto-couplers, PLLs, bridge rectifiers, sample-and-hold circuits, Schmitt triggers, tone decoders, varistors, vcos, voltage followers, voltage regulators, and more. Typical descriptions cover: name of part, signal names, detailed operation, and examples of key specification parameters.

For more information, contact *Micro Logic, Dept. P, PO Box 174, Hackensack NJ 07602; (201)-342-6518.*

REVIEW

IC-37A

Those of you not active on 220 MHz over the past several years could not possibly understand. A new base/mobile rig for 1¼ meters can provoke the same excitement as working XZ on five bands. After all, there hasn't been a credible entry in the 220 base/mobile market since the Midland 13-509 and 13-513, some five years back.

All that has changed now with the introduction of the ICOM 37A. For those who don't already know about it, this rig is part of the series which includes the IC-27A and 27H, and the soon-to-be-released IC-47A. If you haven't seen one of these rigs yet, you have a surprise coming. The 37, like its brothers, is *tiny*. Also, like its brothers, it has a very hot receiver, some very nice features, and a few drawbacks. But I'm getting ahead of myself a bit.

You should know that the rig I got was a demo at Dayton, which should give you some idea of its condition. While certainly undamaged, it had been well pawed over—so I knew it would be an excellent specimen for review. Also, because of this, I got my review unit in an ICOM bag, without either a manual or a box. ICOM did send the manual later. But without the book, I had to learn how to operate the rig on my own, which was difficult. I finally found another IC-37 owner who gave me the information I needed to learn the ropes on the rig. He and several other IC-37 owners also gave me several comments which are included in this review. Don AF9M graciously supplied the use of his two-way-radio shop for the measurements used in this review. Both his 37 and mine were measured.

The very first thing I learned about this rig was its absolutely beautiful transmit audio quality. I was told, right off, that this rig runs rings around anything on the air, and having heard several 37s by now, I have to agree. However, when you get your rig, be prepared to drop by the local two-way shop or local repeater techie and have your deviation checked. Both my rig and AF9M's had the modulation cranked up too high. Both the mike gain and deviation potentiometer could stand minor adjustment. Also, have you PL™ deviation checked—it may be too low. The sine wave coming out of the PL generator is so pure that, without any harmonics of any kind, the typical PL detector will be somewhat at a loss as to what to do with it. Really! As supplied, the PL deviation is set for 500 Hz. 750 Hz will do the job much better.

The receive audio is not quite as pretty, but let's be fair about this. The rig is tiny (remember?) and there is simply no room in there for a luxury speaker. In a home listening environment, the internal speaker is very adequate. In the relatively high ambient noise level of an automobile, a better speaker is a *must*. Enough said.

Receive sensitivity is no problem, and no additional preamp is needed. It specs out at .20 μV/m for 12 dB Sinad. Be careful when making Sinad measurements. Although nobody else had this problem, the audio stage of my rig went into oscillation and died when we hooked the leads across the speaker. No, we didn't short anything out. My rig just didn't like test leads, that's all.

One other aspect of receiver performance worth noting is the ability to handle high-rf environments, such as in downtown urban areas. The IC-37 seems to hold its own in downtown Chicago, though we're trying more testing.

Back on the transmit side there is more good news. This rig is clean, clean, clean. All of the IC-37s which were tested checked out at 80 dB down for spurs and 75 dB down for harmonics. White noise (checked on my rig only) was down 65 dB from the carrier output 50 kHz either side of the carrier. Yes, the rig could almost be used in repeater service.

I said, "almost." I found only two complaints from users about the IC-37, and the big one is *heat*. The case gets beastly hot during transmit, sometimes too hot to touch. Now I know that there have been no failures in any IC-37A to date which could be traced to heat, so I know that ICOM seems to have done their homework in the thermal-design department. But I'm from the school which says, "too hot to touch is too hot," and this still scares me a lot. Two thoughts on this: First, both high *and* low power are adjustable. Yes, the rig is rated at 25 honest Watts and yes, it will honestly put out those Watts. But if you're a bit squeamish about heat like I am, you may want to back down the high-power output to, say, 18 or 20 Watts and get yourself some insurance against heat failure. Second, it is mandatory to make sure that: a) the rig is well ventilated, and b) the cover is buttoned-down tight on the rig if you're going to transmit with it. ICOM has designed the 37's mechanical structure so that the entire case is a heat sink, and it needs all of it.

While we're still in the gripe department, there is a problem with the offset system in the IC-37A. The rig, as supplied, is programmed for an automatic −1.6-MHz offset in the repeat mode, unless you change it. So far, so good. However, if you wish to change to another offset, you can only program offbeat offsets in 100-kHz increments. The fact that you can't do it in 10-kHz increments is a real

The IC-37A 220-MHz transceiver from ICOM.

WHAT DO *YOU* THINK?

Have you recently purchased a new product that has been reviewed in *73*? If you have, write and tell us what *you* think about it. *73* will publish your comments so you can share them with other hams, as part of our continuing effort to bring you the best in new product information and reviews. Send your thoughts to Review Editor, *73: Amateur Radio's Technical Journal*, Peterborough NH 03458.

problem, and I would strongly suggest that ICOM change the software in their controller to allow 10-kHz-offset adjustment increments. That's it on the complaints.

The instruction manual is the typical well-done ICOM book. What more can I say? The schematic is clean and well laid-out. All rig adjustments are well documented, and the text is very straightforward.

There is, at this time, one option available with the rig, a speech synthesizer. When this option is in place and the speech button is pushed, the frequency on the display (receive or transmit) is spoken through the speaker by a synthesized female voice. I am not sure I would take this option, although it may be useful in the car when I have to watch the road and not the rig. However, for the sightless ham, this is the only way to go. The $30 price is more than worth it.

The PL generator (standard) is right on the money, frequency-wise, though as mentioned earlier, it is a little on the low side, deviation-wise. In the memory modes, the correct PL is automatically keyed in on those frequencies where you need it. However, it only works in the duplex mode, not on simplex.

Other nice features include up/down switches on the mike to help prevent auto accidents when you're tuning the rig, two vfos, and three modes of scanning: memory, band segment, or the entire band. I find the scanning rate a little slow in the memory mode and would suggest that the fast/slow scan switch (a DIP switch inside the rig) be left on fast at all times. Other nice touches: fuses on *both* the positive and the negative supply leads. If something goes wrong in your car's electrical system, you'll thank ICOM for their forethought. The mobile mount is well designed, rugged, and functional. And finally, there is provision for an outboard battery for the memory in the power plug.

A lot more could be written about this rig, and probably will be in the months to come. It would suffice to say, however, that with everything taken into account, the IC-37A was well worth waiting for. It may not be too farfetched to suggest that this may be the next standard rig for 220 FM. The IC-37A is priced at about $450 (without synthesizer option).

For further information, contact *ICOM America, Inc., 2112-116th Ave. NE, Bellevue WA 98004; (206)-454-8155.* Reader Service number 484.

Art Reis K9XI
New Lenox IL

NCG 7-21-50

If you didn't know to begin with, you probably wouldn't be able to tell that this little transceiver is a QRP rig. On-the-air reports are very satisfying, with praise for good audio and clean CW keying. The receiver compares very favorably with others I've used, particularly with respect to recovered audio. It's crystal clear and plenty loud when you want it to be.

What I'm talking about is NCG's newest import from Japan—a neat, small, three-band quality package that sells for $445. The 7-21-50 seems to fill a gap between the full-house transceivers that cost an arm and a leg and those which offer only CW or a single band.

If you're wondering about coverage, you get 300 kHz on 40 meters, 450 kHz on 15 meters, and 500 kHz on 6 meters! That's right—*six meters*. As you may have guessed, these three bands are permitted in Japan for the Class-B (ten-Watt) group of operators who build their skills (considerable, at that) while using low power. Don't sneeze at ten Watts, however, because it's enough for worldwide communications under favorable band conditions. In a little over an hour of part-time operating, I've been able to work Arizona on 15-meter phone, New Mexico on 15 CW, Kansas on 40 CW, and Virginia, South Carolina, and Tennessee on 40 phone. Nope, I haven't worked any six-meter stations yet, but I haven't heard any either—in spite of considerable listening. Peterborough, New Hampshire is not exactly the hub of VHF activity these days, and we're just far enough from Boston (with lots of hills in between) to be unable to pick up their local 6-meter activity. During the time I have been listening on six, there hasn't been any sporadic-E propagation, either. There's no doubt in my mind that the results on six will be as favorable as those on the other two bands as soon as things "hotten up" a bit.

IC-37A

	Spec	Measured
Power requirements	13.8 volts	
high power	6.5 Amps	6.2 Amps
low power	3.0 Amps	2.4 Amps
receive	0.5 Amps	
Rf output	25 Watts	23.5–25.5 Watts (adjustable)
Rf output/input impedance	50 Ohms	
Receiver sensitivity	0.2 μV/m, 12 dB Sinad	0.2 μV/m, 12 dB Sinad
Maximum frequency deviation	±5 kHz	±6 kHz
Spurious emissions	60 dB below carrier	65 dB, white noise 75 dB, harmonics 80 dB, others

Circuit Features

The local-oscillator section uses a phase-locked-loop system in which the vfo output is used as one input for the phase comparator and a mixed-down vco signal is used for the other input. With this arrangement, the vco output can be used as is for the local-oscillator signal. This reduces internal beat noise during reception and minimizes production of spurious signals during transmission. The phase-comparator frequency is in the 700-kHz range, which tends to reduce adverse S/N-ratio effects sometimes found with normal PLL systems. The transceiver's frequency stability is exactly the same as that of the vfo, which can be quite good through the use of temperature compensation and the fact that it is a low frequency (in the 3-MHz range) to begin with.

In the receiver section, switching between lower sideband and upper sideband is automatically accomplished when the bandswitch is changed, ensuring that the proper sideband is always in use no matter which band is in use. A 9-MHz monolithic filter removes unwanted nearby signals from the i-f frequency, which is then amplified and product detected in the usual manner by the 3-stage i-f amplifier. For SSB, the detected af signal is sent to the audio amplifier, but for CW, it first passes through an op-amp active filter for improved selectivity.

The noise blanker employs an IC to amplify mixer output noise, which is then rectified and dc amplified before being applied to the i-f on/off gating circuit.

The transmitter uses the filter-type SSB generation scheme, with an i-f frequency of 9 MHz, in a single-conversion circuit. Voice signals are amplified by low-noise transistors and presented to a balanced-modulator IC, which produces a DSB signal without a carrier. The DSB signal passes through a monolithic filter which removes the carrier, resulting in the desired SSB signal. The desired SSB signal is amplified by i-f amplifier and then frequency converted by a double-balanced mixer to the desired output frequency. An LC bandpass filter removes spurious signals from the mixer's rf output signal, which is then amplified to the 10-W output level by a 7–50-MHz wideband amplifier. The wideband amplifier features a push-pull configuration in all three stages (preamplification, driver, and final amplifier), reducing distortion and cancelling even harmonics. The amplified 10-W signal then passes through low-pass filters for each band to remove harmonic components, and is then presented to the rf output connector. A portion of the drive power is rectified in a negative-feedback circuit and presented to the input gate of the FET i-f amplifier, reducing its gain and causing the ALC indicator's LED to light.

It is recommended that the antenna vswr not exceed 1.5:1 without the use of an antenna tuner. It is also suggested that continuous CW output be limited to no more than 3 minutes. For RTTY or SSTV use, the microphone gain control should be turned down to reduce the rf output to about 50% or less of the rated output (to avoid excessive heat and damage to the final solid-state power amplifiers). The operator is cautioned never to change the bandswitch while transmitting or operate the transmitter without an antenna connected to the output terminal—otherwise the power-amplifier transistor will be damaged.

The NCG 7-21-50.

NCG 7-21-50

Size
9-3/4" × 4-3/8" × 11-3/4"
11 pounds
Frequency Range
40 meters—7.0–7.3 MHz
15 meters—21.0–21.45 MHz
6 meters—50.0–50.50 MHz
Mode
SSB—lower on 40-meter band, upper on 15- and 6-meter bands
CW—all bands
Stability
From one minute to sixty minutes after switch-on, within ±1 kHz. Thereafter, within 100 Hz per thirty minutes
Power (Input/Output)
26 Watts PEP input
10 Watts PEP output
Power Supply
ac—120 V, 60 Hz
dc—13.8 V ±10% (negative ground)
Antenna Impedance
50 Ohms, nominal unbalanced coax
Suppression
SSB—50 dB or more (1.5-kHz modulating frequency)
Carrier—40 dB or more
Spurious—40 dB or more (40 and 15 meters); 60 dB or more (6 meters)
Receiver
Single conversion superheterodyne using a 9-MHz i-f on SSB and an 8.9993-MHz i-f on CW
Sensitivity
Better than 0.25 microvolts for a 10-dB S/N
Selectivity
SSB: −6 dB ±1.1 kHz, −60 dB ±3 kHz maximum
CW: −6 dB ±200 Hz, −60 dB ±3 kHz maximum
Image Ratio
Greater than 60 dB
I-f Rejection
60 dB or greater
Other Spurious
70 dB or greater
Delta F (Incremental Tuning) Range
±1.5 kHz
Audio Output Power
Internal speaker—0.5 W at 10% distortion at 8 Ohms nominal
External speaker—1.5 W at 10% distortion at 8 Ohms nominal

Conclusion

The first (very slight) reservation I have about this neat little rig is the fact that only the "normal" sideband is provided for each band, which effectively prevents one from receiving or transmitting on the "opposite" sideband. This is something that I rarely do, anyway, so the loss is negligible with regard to my operating habits. The other reservation I have is about the ultra-fast tuning. By that I mean the large

frequency excursion with each rotation of the tuning dial. Fortunately, the dial is fairly firm, and a careful touch can be developed to tune in a station without too much trouble. Also, the built-in fine-tuning arrangement, using the "delta F" controls, simplifies matters greatly. If you tend to be a frequency hopper, you will like the fast tuning which permits you to jump from low to high end of any band in a few quick turns of the knob.

Otherwise, I can't really fault any aspect of this little rig...not even the 10-Watt output. It would be very easy to provide a nice solid-state external linear amplifier that could give the output of a more usual station transceiver. For the low price you pay compared to other rigs, you won't be getting all of the bells and whistles, but you will be getting a really good CW filter, good audio reports, and a go-anywhere transceiver suitable for portable/mobile QRP operation on either 12 volts dc or 110 volts ac. You don't have to buy any kind of external power supply and you don't have to buy a microphone. You will need only a key of your favorite type and an antenna. Portability, simplicity, digital frequency readout, light weight, small size, a built-in speaker, and many other things you'll like are standard equipment with the NCG 7-21-50. Of course, you didn't expect big-rig performance, and I won't kid you into thinking that you'll get it every time...but you will be happily surprised at the reports you do get, and even happier with the price.

For complete details, contact *NCG, PO Box 2331, Anaheim CA 92804.* Reader Service number 487.

Jim Gray W1XU
73 Staff

BELDEN 9913 COAX

Ordinarily, the introduction of a new type of coaxial cable would not merit a write-up in an amateur-radio journal. However, Belden's new type 9913 RG-8/U cable is such a radical departure from previous RG-8/U-type cables that it does indeed merit such attention—not only from its intended market, the new 800-MHz cellular-radio service, but from amateur VHF/UHF enthusiasts as well.

What makes 9913 different from other conventional RG-8/U coaxial cables is its construction: Belden uses a single, solid #10 copper wire for the center conductor, then encases it in a polyfoam-type dielectric. The difference is that only a small, spiral-shaped portion of the dielectric actually rests against the center conductor. The balance of the dielectric immediately surrounding the center conductor is—you guessed it—air. And air makes an excellent dielectric at VHF/UHF frequencies, which would indicate good low-loss performance from 50 MHz through 1000 MHz.

The shield is clever, too: A thin film of solid aluminum foil is durabonded to the dielectric to provide 100% shield coverage. Wound around this is about 60%-coverage tinned wire to facilitate solder connections. The final cover is the black UV-resistant poly jacket. All this in a cable that has the same outside dimensions as conventional RG-8/U cables! The best description of 9913 would be a cross between hardline and CATV-type RG-59/U coaxial cable.

As might be expected, 9913 is not a truly flexible line. It could best be described as semi-rigid coaxial cable, as opposed to rigid-aluminum or corrugated-jacket cable. Yet, the minimum bend radius is specified at 8 inches. Try that with a piece of 1/2" hardline sometime! 9913 will fit all standard coax fittings for RG-8/U cables, such as UHF and N connectors (requiring some modifications on the latter).

Tests were performed by the members of SCORE (Society of Contest Operators and Radio Experimenters) to determine the actual loss an average amateur might see in normal use. Tests were made using nothing more than high-power rf sources on each band and two Bird Model 43 wattmeters at each end. Additionally, a Bird Termaline coaxial resistor was connected at the end to present a constant 50-Ohm impedance to the source through 1 GHz. We swept an entire 1000-foot put-up on every band except 1296 MHz, where the unavailability of high-power equipment resulted in our testing only a 100-foot piece of cable. All tests were done using type-N connectors throughout.

Results are shown in Fig. 1, and they are very good indeed. 9913 holds its own against most conventional transmission lines through about 30 MHz (including Belden's other non-standard RG-8/U, type 8214), but there is a dramatic difference above this frequency. Consider that most conventional RG-8/U cables have over 2.5 dB loss at 144 MHz, while 9913 comes in almost 1 full dB lower. Not only that, a figure of 2.7 dB per 100 feet at 432 MHz for a soft transmission line such as RG-8/U is outstanding. Most other cables will exhibit a loss anywhere from 3.5–5 dB at this frequency!

Clearly, this cable was designed with the 800-MHz cellular user in mind. The lucky hams who have been able to obtain lengths of 9913 (the factory has it constantly back-ordered) have put it to a myriad of uses. Several are even using it as feedlines for antennas at up to 1296 MHz. Two amateurs in Florida are claiming a QRP DX record on 1296 MHz using 350 microwatts through about 100 feet of 9913 to loop yagis. The distance worked was over 320 miles! Some simple math will tell you that only about half the power made it to the antenna—a pretty impressive record, in any event. Try that with conventional RG-8 and the loss will be about 8–10 dB per 100 feet.

Here at KT2B I use 9913 for 65-foot-long transmission lines at 144 MHz and for pigtails on 432 and 1296 from 1/2" hardline. The loss at 144 MHz compares favorably with 1/2" hardline and the loss at 1296 is only about 2 dB worse than Prodelin 1/2" Spir-O-Line cable, which uses a similar spiral dielectric. 9913 works exceptionally well at HF as a high-power coaxial line. The large center conductor can handle many Amps of rf current and the dielectric will not break down as easily as regular RG-8/U. Our group, SCORE, is currently testing 9913 for use as coaxial-balun material on 20- and 15-meter beams.

Now—about using coaxial connectors. If you prefer PL-259/UHF-type connectors, you will find the installation the same as with regular RG-8/U cable. The #10 center conductor makes a snug fit into the center pin. The braid, however, is somewhat tricky to secure. I suggest tinning the braid lightly with a soldering iron of no more than 40 Watts rating. Do not use a 100/150-Watt gun, as you run a risk of melting or distorting the dielectric! This will ruin the performance of the cable and likely cause a severe impedance bump at the joint. If you lightly tin the braid, then it will be easy to solder through the solder holes on the plug and finish the connection. Again, use a low-wattage iron. Don't try to remove the aluminum foil from the center dielectric when you pull the braid back either. At 50 MHz, 144 MHz, and 220 MHz, it is a very good idea to use PL-259s with a Teflon™ dielectric. Amphenol makes these and several radio distributors sell them for about $2.00 each.

Type-N connectors are another story. Since this is a relatively new cable, it'll take some time before the major connector manufacturers come out with a 50-Ohm type-N plug that will accommodate the #10 center conductor. Until then, you'll have to do as I did and file down the center pin until it is about #12 in diameter. It is frustrating, but the results are worth it. Additionally, you should try to use connectors that employ both a front-washer contact (between the braid and shell) and a back washer (between the rear nut and rear rubber gasket). Otherwise, you are likely to pull the connector off the first time you twist it! 9913 depends on its foil for shielding and the braid is not substantial, so a friction fit with conventional type-N connectors may be undependable. Kings Mfg. Co. makes a line of type-N connectors that employ both back and front washers and I recommend these highly. Failing that, you can use regular type-N connectors if you install a front washer yourself. Without it, you'll have a loose connection!

In summary, Belden 9913 makes an excellent all-purpose flexible line with some of the characteristics of hardline. It is an outstanding performer at VHF and UHF, and is the answer for those using crank-up towers with VHF/UHF arrays on them. 9913 is available through dealers for about 43¢–48¢ per foot, in 100-foot lengths.

For more information, write *Belden Corp., Elec. Div., Dept. G, PO Box 1980, Richmond IN 47374.* Reader Service number 486.

Peter Putman KT2B
Morris Plains NJ

Frequency in MHz	Loss in dB/100 ft
28.0	0.8
50.0	1.0
144.0	1.6
220.0	2.0
432.0	2.7
1296.0	5.2

Fig. 1. Loss figures for Belden 9913 coaxial cable, as determined experimentally.

SATELLITES

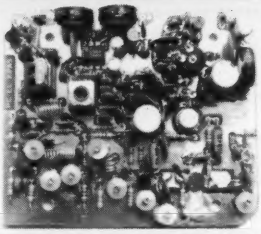
USING THE AO-10 APOGEE PREDICTIONS

Apogee predictions for the month of December are provided for three sections of the United States: Washington DC at 39N 77W, Kansas at 39N 95W, and California at 38N 122W. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

AMSAT-OSCAR 10 APOGEE PREDICTIONS
DECEMBER 1984

			WASH		KANSAS		CALIF	
ORBIT	DAY	TIME	AZ	EL	AZ	EL	AZ	EL
1434	1	0200	263	20	249	34	218	54
1436	2	0100	256	30	240	44	197	60
1438	3	0000	247	40	226	53	171	62
1440	4	0000	240	42	215	53	160	58
1442	4	2300	227	50	195	59	139	54
1444	5	2200	209	58	170	60	122	47
1446	6	2200	197	57	160	56	119	41
1448	7	2100	173	59	139	52	108	33
1450	8	2000	149	57	123	46	98	24
1452	9	2000	143	51	120	40	97	18
1454	10	1900	126	45	108	32	89	10
1456	11	1800	113	38	99	23	81	1
1458	12	1800	111	32	97	17		
1459	13	0500					273	8
1460	13	1700	101	23	89	9		
1461	14	0400					267	18
1462	14	1600	92	15	81	1		
1463	15	0400					262	20
1464	15	1500	85	6				
1465	16	0300			272	8	254	31
1466	16	1500	83	1				
1467	17	0200	277	4	266	18	246	40
1469	18	0200	272	6	260	21	238	42
1471	19	0100	266	16	253	31	224	51
1473	20	0000	259	26	243	40	206	58
1475	21	0000	252	28	235	42	194	57
1477	21	2300	243	38	222	50	170	58
1479	22	2200	232	47	203	57	147	56
1481	23	2100	216	55	179	60	128	50
1483	24	2100	205	55	169	57	124	44
1485	25	2000	182	58	146	54	112	36
1487	26	1900	158	58	129	48	102	27
1489	27	1900	150	53	125	42	100	21
1491	28	1800	132	48	112	35	92	13
1493	29	1700	118	41	102	26	84	4
1495	30	1700	115	35	101	20	83	0
1497	31	1600	107	30	96	18		

AMATEUR TELEVISION



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See List of Advertisers on page 80

SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices, 73 Magazine, Pine St., Peterborough NH 03458.

BULLHEAD CITY AZ
NOV-DEC

Bullhead City, Arizona and the Western Arizona Radio Club will join forces to celebrate an historic occasion. Bullhead City, a well established community on the Colorado River, became incorporated in late August and is now the newest city in the state of Arizona. In honor of this occasion, during the months of November and December, any station working a member of the Western Arizona Radio Club will be offered an attractive certificate. All amateur bands will be operated, including 2 meters. A QSL and an SASE (6.5" × 9") will be required (include two extra 20-cent stamps for a bonus information package). Address your request to WARC, PO Box 416, Bullhead City AZ 86430.

FARIBAULT MN
DEC 1

The annual Handi-Ham Winter Hamfest will be held on Saturday, December 1, 1984, at the Eagles Club in Faribault MN. Registration will begin at 9:00 am. There will be a Handi-Ham equipment auction, a program, and dinner at noon. Talk-in on .19/.79. For more information, contact Don Franz **W9FIT**, 1114 Frank Avenue, Albert Lea MN 56007.

SANTA CLAUS IN
DEC 1-2

The Pike County Amateur Radio Club of Winslow IN will operate station W9CZH beginning at 1700Z, December 1, 1984, until 1700Z, December 2, 1984. The approximate frequencies will be 3.925, 7.265, 14.265, and 21.395 phone, 7.133 CW, and 146.52 FM. A special QSL/Xmas card postmarked from the Santa Claus Post Office will be sent upon receipt of an SASE to W9CZH, RR 1, Box 311, Winslow IN 47598.

EVERGLADES NATIONAL PARK
DEC 1-2

The Everglades ARC will operate special-event station W4SVI on December 1 and 2, 1984, to commemorate the 37th anniversary of the dedication of the Everglades National Park. W4SVI will operate from Flamingo on the southern tip of Florida between 1300Z and 2300Z both days. Frequencies: lower edge of the 10-to-40-meter General phone bands as well as 146.52 FM. Certificate for large SASE to Everglades ARC, 14511 SW 287 Street, Leisure City FL 33033. Enclose your QSL card for display at the Miami Hamboree in February.

BETHLEHEM PA
DEC 21-23

The Delaware-Lehigh Amateur Radio Club (W3OK) in conjunction with the Christmas City, Bethlehem PA, will operate December 21-23, 1984, from 1500Z to 0200Z, on frequencies 3990 kHz, 7299 kHz, 14,225 kHz, 21,325 kHz, and 28,525 kHz. For a certificate of contact, send a large SASE to DLARC W3OK, Greystone Building, Gracedale, Nazareth PA 18064.

SOUTH BEND IN
JAN 6

A hamfest swap and shop will be held on Sunday, January 6, 1985, at the Century Center, downtown on US 33 Oneway North between the St. Joseph Bank Building and the river, South Bend IN. Open tables are $1.00 per foot in a carpeted half-acre room. The Industrial History Museum is in the same building. Four-lane highways lead to the site from all directions. Talk-in on .52/.52, .99/.39, .93/.33, .78/.18, .69/.09, and 145.29. For more information, contact Wayne Werts K9IXU, 1889 Riverside Drive, South Bend IN 46616, or phone (219)-233-3507.

WEST ALLIS WI
JAN 12

The West Allis Radio Amateur Club will sponsor the "Original" Annual Midwinter Swapfest on Saturday, January 12, 1985, beginning at 8:00 am, at the Waukesha County Expo Center Forum (take I-94 to Co. F, south to FT, west to Expo). Admisson is $2.00 in advance and $3.00 at the door. Four-foot tables are $3.00 in advance (December 31st deadline) and $4.00 at the door. Food will be available. For

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Chap. 1 The Exciting World of Amateur RTTY
Chap. 2 Operating Parameters and Concepts of RTTY
Chap. 3 Straight Talk on Home Computers and RTTY
Chap. 4 RTTY Systems for Home Computers
Chap. 5 RTTY Converters You Can Build
Chap. 6 Dedicated RTTY Terminals and Systems
Chap. 7 New Mini-RTTY Systems
Chap. 8 Fascinating RTTY Outside the Amateur Bands Press—Military—Weather, Etc.
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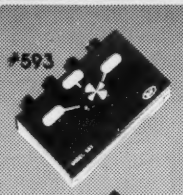

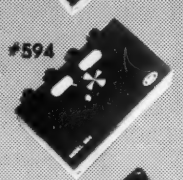

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tickets, send an SASE to WARAC Swapfest, PO Box 1072, Milwaukee WI 53201.

RICHMOND VA
JAN 13

The Richmond Amateur Telecommunications Society will sponsor the eighth annual Richmond Frostfest on Sunday, January 13, 1985, from 8:30 am to 3:30 pm, at the Virginia State Fairgrounds. General admission is $4.00. Flea-market spaces are $3.00 without a table and $7.00 with an 8-foot table. Booths with side curtains and backdrops are available to dealers and exhibitors and the building will be open Saturday afternoon for setup (there will be armed security at all times). The entire show will be indoors with no outside tailgating. The deadline for booths is December 30, 1984, and for the flea market January 10, 1985. For more information, write Richmond Frostfest, PO Box 1070, Richmond VA 23208, or call Bill Scruggs N4DDM at (804)-272-8206.

SOUTHFIELD MI
JAN 20

The Southfield High School Amateur Radio Club will sponsor its 20th annual Swap and Shop on January 20, 1985, from 8:00 am to 3:00 pm, at Southfield High School, 24675 Lahser, Southfield MI. Admission is $2.50. Two 8-foot reserved tables are $20.00 and each addtional reserved table is $10.00 (paid in advance). Tables will be available at the door. Doors will open at 6:00 am for exhibitors. There will be plenty of parking and food. All profits go toward electronics scholarships and to support the activities of the Southfield High School Amateur Radio Club. For more information, advance tickets, and/or reservations, write Mr. Robert Younker, Southfield High School, 24675 Lahser, Southfield MI 48034. Indicate with your reservation whether you will need wall space and/or electrical outlets. All table reservations will be confirmed.

YONKERS NY
JAN 27

The Yonkers Amateur Radio Club will sponsor the Yonkers Electronics Auction on Sunday, January 27, 1985, from 9:00 am to 3:00 pm, at Lemko Hall, 556 Yonkers Avenue, Yonkers NY. Admission for buyers and sellers is $3.00 each; children under 8 will be admitted free. New and used equipment will be auctioned and can be inspected from 9:00 am to 10:00 am. There will be plenty of seats and parking and the auction will start at 10:00 am sharp. Unlimited free coffee will be available all day. The club will charge a 10% commission on the first $100 and 5% on the remainder on successful sales only. Talk-in on 146.265T/146.865R, 440.150T/445.150R, and .52 direct. For more information, write YARC, 53 Hayward Street, Yonkers NY 10704, or phone (914)-969-1053.

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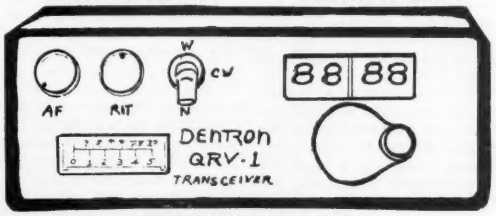

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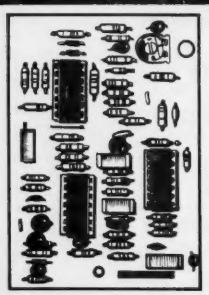

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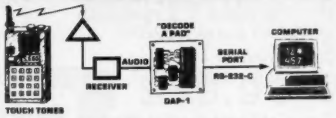

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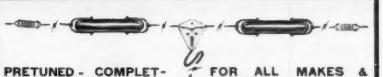

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CONTESTS

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ARRL 160-METER CONTEST
Starts: 2200 UTC December 1
Ends: 1600 UTC December 2

The object is for amateurs worldwide to exchange QSO information with W/VE amateurs on 1.8 MHz, CW only. DX-to-DX QSOs are not permitted for contest credit. Operating categories include single-operator and multi-operator (single transmitter only). Remember that W/VE stations may transmit only in the 1800–1825- and 1830–1850-kHz segments, in conformance with the ARRL band plan. Please refrain from using the 1825–1830-kHz DX window.

EXCHANGE:

RST and ARRL section, DXCC country name, or ITU region (if maritime or aeronautical mobile).

SCORING:

Count 2 points per QSO with amateurs in an ARRL section. W/VE stations count 5 points for DX QSOs. Multiply QSO points by the total number of ARRL sections (74 max.) and DXCC countries (W/VE stations only).

ENTRIES:

Official forms and logs are recommended and are available from ARRL headquarters for an SASE or 2 IRCs. Logs must indicate time in UTC, call, and exchange. Multipliers should be clearly marked in the log the first time worked. Entries with more than 200 QSOs must include cross-check sheets. Entries must be postmarked by January 4 and sent to the ARRL, 225 Main St., Newington CT 06111.

Certificates will be awarded to the top-scoring single operator in each ARRL section and DXCC country, and to the top-scoring multi-operator station in each ARRL division and continent. Usual ARRL conditions of entry and disqualification apply.

ARRL 10-METER CONTEST
Starts: 0000 UTC December 8
Ends: 2400 UTC December 9

Contact as many stations as possible on the 28-MHz band, using no more than 36 hours of the 48-hour contest period. Listening time counts as operating time! Entry categories include: single-operator mixed-mode (phone and CW), phone only, or CW only. Multi-operator class is for single-transmitter, mixed-mode only.

No crossmode contacts are allowed. Mixed-mode single-operator and all multi-operator stations may work stations once on CW and once on SSB. One operator may not use more than one callsign from any given location during the contest period. All entrants may transmit only one signal on the air at any given time.

EXCHANGE:

W/VE stations (including KH6/KL7) send RS(T) and state or province. DX stations send RS(T) and serial number starting with 001. Maritime and aeronautical mobile stations send RS(T) and ITU region (1, 2, 3). Novice and Technician stations sign /N or /T as appropriate.

SCORING:

Count 2 points per phone QSO, 4 points per CW QSO, and 8 points for QSOs with US Novice or Technician stations. Multiply the QSO points by the total number of US states, Canadian call areas, DXCC countries (except US and Canada), and ITU regions (maritime and aeronautical mobile only).

ENTRIES:

Official logs and entry forms are recommended and are available from ARRL headquarters for an SASE or 2 IRCs. Logs must indicate time in UTC, mode, call, and exchange for each QSO. Multipliers should be clearly marked in the log the first time worked. Entries with more than 200 QSOs must include cross-check sheets. Entries must be postmarked by January 11 and sent to the ARRL, 225 Main St., Newington CT 06111.

Certificates will be awarded to: the highest-scoring single-operator station in each category from each ARRL section and DXCC country, the top multi-operator entry in each ARRL division and each continent, and additional entries as participation warrants. Usual ARRL entry conditions and disqualification rules apply.

CANADA CONTEST
Starts: 0000 UTC December 30
Ends: 2400 UTC December 30

Sponsored by the Canadian Amateur Radio Federation (CARF), the contest is open to all amateurs and everybody works everybody. Entry classes include single-operator allband, single-operator single-band, and multi-operator allband.

Use all bands from 160 to 2 meters on CW and phone combined. All contacts with amateur stations are valid. Stations may be worked twice on each band, once on CW and once on phone. No crossmode contacts and no CW contacts in the phone bands are allowed.

EXCHANGE:

Signal report, consecutive serial number starting with 001, and province.

SCORING:

Score 10 points for each contact with Canada and 4 points for contacts with other countries. VE0 counts as Canada and one multiplier. Score 20 points for each contact with any CARF official news station using the suffix TCA or VCA. Multipliers are the number of Canadian provinces/territories worked on each band, on each mode (13 provinces/territories × 2 modes for a maximum of 52 possible multipliers per band). Contacts with stations outside Canada count for points but not multipliers.

FREQUENCIES:

1810/1840, 3525/3775, 7025/7070/7155, 14025/14150, 21025/21250, 28025/28500, 50040/50110, 144090/146520. Suggest phone on the even hours (UTC), CW on the odd hours (UTC). Since this is a Canadian-sponsored contest, remember to stay within the legal frequencies for your country!

AWARDS:

A trophy will be awarded to the highest-scoring contestant in each entry class. A certificate will be awarded for the highest score in each category in each province/territory, US call area, and DX country.

ENTRIES:

A valid entry must contain log sheets, dupe sheets or statement, a cover sheet showing claimed QSO points, a list of multipliers, and a calculation of final claimed score. Cover sheets and multiplier checklists are available. Entries should be mailed within one month of the contest, with your comments, photos, etc., to: CARF, c/o N. Waltho VE6VW, General Delivery, Morinville AB, T0G 1P0, Canada.

Results will be published in *TCA*, the Canadian amateur magazine, prior to the next contest. Nonsubscribers of CARF may include an SASE for a copy of the results. The decision of the contest committee shall be final in all cases of dispute.

CALENDAR

Dec 1–2	ARRL 160-Meter Contest
Dec 8–9	ARRL 10-Meter Contest
Dec 26–Jan 1	QRP Winter Sports—CW
Dec 30	CARF Canada Contest
Jan 12	73 40-Meter World SSB Championship
Jan 12–13	Hunting Lions In The Air Contest
Jan 13	73 75-Meter World SSB Championship
Jan 19–20	73 160-Meter World SSB Championship
Jan 26	73 15-Meter World SSB Championship
Jan 26–27	West Virginia QSO Party
Jan 27	73 20-Meter World SSB Championship
Feb 16–17	ARRL DX Contest—CW
Feb 23	RTTY World Championship
Feb 23–24	YL-ISSB Commo System QSO Party—Phone
Mar 2–3	ARRL DX Contest—Phone
Mar 16–17	YL-ISSB Commo System QSO Party—CW
Mar 16–17	Spring QRP CW Activity Weekend
Jun 8–9	Worldwide South America CW Contest
Jul 1	CARF Canada Day Contest
Sep 28–29	Late Summer QRP CW Activity Weekend

LONG ISLAND MOBILE AMATEUR RADIO CLUB Inc.

LIMARC LOG

NEWSLETTER OF THE MONTH

Rounding out the list of winners in 1984 is the journal of the Long Island Mobile Amateur Radio Club—the *LIMARC Log*. Editor Earl Grainger W2NXZ puts together this compendium of news and views, and does it in a consistently professional manner.

There are two areas which the *LIMARC Log* has in common with previous winners: format and content. Of course, the content is first-rate; the newsletter is full of stories and tidbits that are just plain fun to read. A recurring theme among winners seems to be the use of paid advertising. When not overdone, this can provide a steady source of income for the club and will result in a high-quality publication.

On the format side, most successful newsletters are offset-printed using an 8-1/2"-by-5" size, and look like a miniature magazine. Some use colored paper to highlight news and add excitement. The extra price is worth it—a well-presented newsletter will cause your membership roster to grow quickly!

To enter your club's newsletter in *73*'s Newsletter of the Month Contest, send it to *73*, Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

G-QRP-CLUB WINTER SPORTS

Daily from 0900 to 2300 UTC, December 26 to January 1. All radio amateurs interested in QRP are invited to take part in the club's activity. No special exchange information was mentioned in the information provided by the club. The operating schedule for each day is as follow:

0900–1000 UTC	= 14060
1000–1100	= 21060/28060
1100–1200	= 7030
1200–1300	= 3560
1300–1400	= 10106
1400–1500	= 3560
1500–1730	= 21060/28060
1730–2000	= 14060
2000–2100	= 7030/10106
2100–2200	= 3560
2200–2300	= 14060

Reports on the Winter Sports Activity should be sent to Fred Garratt G4HOM, 47 Tilshead Close, Druids Heath, Birmingham B14 5LT, England.

4TH ANNUAL 40-METER WORLD SSB CHAMPIONSHIP
0000Z to 2400Z January 12

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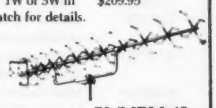

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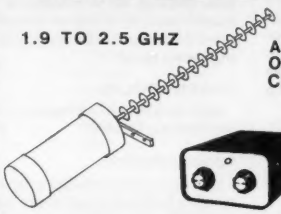

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40-meter phone during the specified times of allowable operation. The same station may be worked only once. Crossmode contacts will not count. Single-operator stations may operate a total of 16 hours. All the multi-operator stations may operate the entire 24-hour period. Off periods must be noted in your log(s) and on your summary sheet. Off periods are *no less than 30 minutes each.*

OPERATOR CLASSES:

(A) single-operator, single transmitter, phone only. (B) multi-operator, single transmitter, phone only.

EXCHANGE:

Stations within the contiguous 48 US states and Canada transmit an RS report and state, province, or territory. All other stations, including Alaska and Hawaii, transmit RS report and DX country.

POINTS:

5 QSO points for contacts with W/VE stations located within the continental 48 US states and Canada. All other contacts score 10 points each. List points for each contact on your log sheet.

MULTIPLIERS:

1 multiplier point is earned for each US state (48 maximum—a District of Columbia contact may be substituted for a Maryland multiplier), each Canadian province or territory (13 max.), and DX Country (excluding the contiguous US and Canada).

FINAL SCORES:

Total QSO points times total multiplier points equals claimed score.

CONTEST ENTRIES:

Each entry must include a contest log, a dupe sheet, a contest summary, and multiplier checklist. We recommend that contestants send for a copy of the contest forms. Enclose an SASE to the contest address listed below.

CONTEST DEADLINE:

Each entry must be postmarked no later than February 12, 1985.

DISQUALIFICATIONS:

Omission of any required entry form, operating in excess of legal power, manipulating of contest scores or times to achieve a score advantage, or failure to omit duplicate contacts which would reduce the overall score more than 2% are all grounds for immediate disqualification. Decisions of the contest committee are final.

AWARDS:

Contest awards will be issued in each operator class in each of the contiguous 48 states, Canadian provinces and territories, and each DX country represented. A minimum of 100 QSOs must be worked to be eligible for contest awards.

CONTEST ADDRESS:

To obtain entry forms or submit an entry, forward an SASE to: 40-Meter Contest, Dennis Younker NE6I, 43261 Sixth Street East, Lancaster CA 93535.

4TH ANNUAL 75-METER WORLD SSB CHAMPIONSHIP 0000Z to 2400Z January 13

SPONSORED BY:

73: Amateur Radio's Technical Journal.

MISCELLANEOUS RULES:

Work as many stations as possible on 75-meter phone during the specified times of allowable operation.The same station may be worked only once. Crossmode contacts will not count. Single-operator stations may operate a total of 16 hours. All multi-operator stations may operate the entire 24-hour period. Off periods must be noted in your log(s) and on your summary sheet. Off periods are *no less than 30 minutes each.*

OPERATOR CLASS:

(A) single-operator, single transmitter, phone only. (B) multi-operator, single transmitter, phone only.

EXCHANGE:

Stations within the contiguous 48 US states and Canada transmit an RS report and state, province, or territory. All other stations, including Alaska and Hawaii, transmit RS report and DX country.

POINTS:

5 QSO points for contacts with W/VE stations located within the contiguous 48 US states and Canada. All other contacts are 10 points each. List points for each contact on your log sheets.

MULTIPLIERS:

1 multiplier point is earned for each US state (48 maximum—a District of Columbia contact may be substituted for a state of Maryland multiplier), each Canadian province or territory (13 maximum), and DX country (excluding the contiguous US and Canada).

FINAL SCORE:

Total QSO points times total multiplier points equals claimed score.

CONTEST ENTRIES:

Each entry must include a contest log, a dupe sheet, a contest summary, and a multiplier checklist. We recommend contestants send for a copy of the contest forms. Enclose an SASE to the contest address listed below.

ENTRY DEADLINE:

All entries must be postmarked no later than February 13, 1985.

DISQUALIFICATIONS:

Omission of any required entry form, operating in excess of legal power, manipulating of contest scores or times to achieve a score advantage, or failure to omit duplicate contacts which would reduce the overall score more than 2% are all grounds for immediate disqualification. Decisions of the contest committee are final.

AWARDS:

Contest awards will be issued in each operator class in each of the contiguous 48 US states, Canadian provinces and territories, and each DX country represented. A minimum of 100 QSOs must be worked to be eligible for contest awards.

CONTEST ADDRESS:

To obtain entry forms or to submit an entry, forward an SASE to: 75-Meter Contest, Jose A. Castillo N4BAA, 1832 Highland Drive, Amelia Island FL 32034.

73'S 6TH ANNUAL 160-METER WORLD SSB CHAMPIONSHIP 0000Z January 19 to 2400Z January 20

OBJECT:

To work as many stations as possible on 160-meter phone in a maximum of 32 hours allowable contest time. Multi-operator stations may operate the entire 48-hour contest period. Stations may be worked only once.

ENTRY CATEGORIES:

(A) single-operator, single transmitter,

G3ZRS, W3BE, AND K8EX RTTY WORLD CHAMPIONS

This year's World RTTY Championship was an absolute thriller. This was the third year of joint sponsorship by the *RTTY Journal* and *73*. Only 4400 points separated single-operator champion G3ZRS from second-place finisher SM6ASD. Throughout the contest there was only a couple-thousand-point margin between many of the contestants.

Peter Rodmell G3ZRS became world champion for single-operator stations while John Johnston W3BE and K. L. Miller VE7YB took the United States and Canadian championships, respectively.

On twenty meters, Dima Slyusarenko UT5RP took a commanding lead for this single-band championship. Piero Giacomelli IK5CKL became the fifteen-meter singles champ.

Mike Bottema K8EX tallied the highest contest score, becoming the world multi-operator champion. For single-band entries, multi-operator Sodermans Regemente SL5AR became the twenty-meter winner with 61,920 contest points.

Everyone apparently had a good time. The enthusiasm of the contestants spreads with each year's event. From the logs received, we've extracted some of the comments made.

RTTY CHAMPIONSHIP SOAPBOX

VE6BEV	This is my first contest. It sure was fun.
VE7ATH	This is my first RTTY contest. I enjoyed it very much. Sure hope conditions are better next time, though.
N7AKQ	Bands were good this weekend. Larger turnout, too! Had a great time and look forward to next year.
WA2KOK	Nice contest. Many signals from Europe.
KØTIV	My first RTTY contest. My greatest thrill was working my first DX.
SP2UUU	Just got my license in October and now all my family is QRV on RTTY. Enjoyed the contest.
VE7VP	Enjoyed the contest and picked up two new countries.
HZ1AB	All continents except Africa. Earned a few new states.
W3BE	Wonderful contest!
PA3DBS	Very nice event. It was my first. Made many nice QSOs, and the conditions were good.
K6WZ	Almost got WAC on 10 meters.
KT1N	Been on RTTY 3 months and only sorry I didn't get started 25 years sooner. Had a ball.
EA5CVR	Enjoyed it very much.
VE6ZX	Enjoyed the contest very much. Forty and eighty meters were tough.
ON7EP	Great test.
SM6ASD	Twenty and fifteen meters exceeded everything I have experienced so far in RTTY contesting. Fantastic activity! I definitely look forward to the years ahead.
WP4AVW/EA4	My very first contest.
CT1AV	Thanks for the test. I am ready for 1985!
GW3EHN	Had power failure. There's always next year—I hope.
GU6JST	Glad to activate Guernsey on RTTY.
WB3FIZ	Good DXing. Both the wife (KA3GIK) and I thoroughly enjoyed it!
K8EX	This is our second year. A good time was had by all.

As Dee Crumpton N6ELP, *RTTY Journal* editor, and her staff put it, "It was fun, a lot of work, a lot of headaches compiling the scores, but we would do it all over again, anytime."

Our special thanks to Dee and the staff! Without the *RTTY Journal* behind this RTTY classic, we are sure this third annual event would not have made it this far. It's getting bigger and better each and every year. See you all next February for the 4th Annual World RTTY Championship.

RESULTS

1983 VK/ZL/O CONTEST

North America
Phone Transmitting
24 Hours

	Band	Total Score
K6SVL	All	27000
W3GM	All	6526
W7PQE	All	2552
K9GTQ	All	540
N4MM	All	306
WA3HUP	20	1800
VE3GCO	20	1320
W2FCR	20	576
VE3FEA	20	224
N1BRT	20	150
KW2J	20	54
K1BV	20	30
WØGOQ	10	1794
AA6EE	10	24

North America
CW Transmitting

	Band	Total Score
KFIZ	All	10406
W3GM	All	8020
W8UVZ	All	5184
K4JRB	All	4648
K4PI	All	2860
K3ND	All	1886
KW2J	All	1792
AJØN	All	1548
W7PQE	All	1088
K9VKY	All	928
NE8I	All	784
KA7FEF	All	400
VE2AEJ/3	All	306
K3NTD	All	224
AA6EE	All	192
W9YCV	All	50
KA2MXO	10	144

1984 RESULTS
WORLD RTTY CHAMPIONSHIP

Single-Operator Category—All Bands

Peter Rodmell	—G3ZRS	—145,520
Bo Stjernberg	—SM6ASD	—141,120
Jorgen Dudahl	—OZ1CRL	—136,300
John Johnson	—W3BE	—132,480
Barry Gardner	—W3FV	—118,340
Perozzo Etienne	—ON7EP	—94,205
Buraro Detudamo	—C21BD	—90,475
K. L. Miller	—VE7YB	—87,400
Vance Fauver	—WB5HBR	—87,360
Carl Steavenson	—K6WZ	—84,240
Andy McLellan	—VE1ASJ	—79,395
Roy Gould	—K7IN	—77,015
Dave Earnest	—HZ1AB	—67,500
Mort Toussaint	—N7AKQ	—64,800
Dan Kernan	—WA2KOK	—60,160
Olli Savolainen	—OH2BDN	—58,650
Roger Simpson	—NQ6C	—56,000
Talma de Barros	—PP7GV	—54,400
Mrs. E. Farida	—LX2EL	—53,865
Alle Lofgren	—SM7AIA	—53,235
Bill Snyder	—W0LHS	—44,745
Clark Constant	—W9CD	—41,600
Denis Mahoney	—VE6ZX	—40,590
Jesus Dominguez	—EA1AEB	—37,675
Pepe Ferrer	—EA5CVR	—33,280
John Lee	—K6YK	—31,850
John Possehl	—W3KV	—31,255
Walt Amos	—K8CV	—30,805
Jose Stragia	—LU8ESU	—30,550
Jack Reed	—WA7LNW	—30,195
Lars Kjellgren	—SM7LSU	—28,575
James Swan	—VK2BQS	—23,690
T. H. Holtby	—VE7VP	—22,560
Willy Rogg	—HB9HK	—22,035
Werner Ludwig	—DF5BX	—19,110
Victor Holyoake	—G4OJJ	—17,415
J. O. Thomas	—GW3EHN	—17,000
Chuck Prindle	—W6JOX	—16,740
Robert Miller	—KB9SU	—16,720
Jan Kus	—SP9BCH	—15,120
Bob Lewis	—N4GXP	—14,070
P. M. Hendricx	—PA3DBS	—13,650
Jules Freundlich	—W2JGR	—12,420
Edwin Cortes	—WP4AVW	—10,230
John Orton	—WA6BOB	—9,990
Charles LeGrande	—AH6CS	—9,440
Dennis Grinnell	—G4MKO	—9,000
Greg Hanson	—KA1ZX	—8,835
Armando Mateos	—EA1AAO	—8,400
Arpad Sarkezi	—YU7AM	—8,370
Kurt Wustner	—DE1KWD	—7,750
Wolfgang Ferrling	—DL0DO	—7,250
Askene Vestermarie	—OZ1GRF	—6,750
Jake Meyer	—HP1XUL	—5,800
Elliott Hamilton	—WA9JIQ	—5,720
Carlos Laroca	—PY2CAR	—5,460
Zdenek Kasek	—OK2BFS	—4,590
Roger Bjerke	—KC0UM	—3,600
Juan Montalvo	—EA2AOV	—3,465
Neal Morris	—K0TIV	—3,255
Wagner Viado	—YU2CB	—1,625
Kryzys Ulatowski	—SP2UUU	—1,155
Diet Platthaus	—DJ6QO	—1,000

Single-Operator Category—20 Meters

Dima Slyusarenko	—UT5RP	—84,240
Larry Bruggensmith	—KI4BQ	—39,015
Jurgen Bieber	—DL9MBZ	—15,250
Tomas Asenjo	—EA4SB	—14,720
David Smith	—W6NCR	—12,950
Dusil Miroslav	—OK1AWC	—12,000
K. Tetterlaar	—VE7ATH	—11,220
Paul Clifford	—WA2AXO	—10,880
Leslie Harper	—W8CFJ	—9,990
Joe Hungate	—K8OM	—7,685
Kenneth Cote	—VE6BEV	—7,155
Kari Syrjanen	—OH5YW	—7,140
Richard Kriss	—KD5VU	—3,630
Ari Rodrigues	—PT2BW	—3,225
B. Strandberg	—SM6IJF	—1,260
Gary Moles	—ZL2AKI	—1,100

Single-Operator Category—15 Meters

Piero Giacomelli	—IK5CKL	—29,150
Hiroaki Kubo	—JR6YAH	—28,380
Norman Buckley	—KC7RG	—10,880
Miguel Quijano	—WA2HLV	—5,610
Roger Thering	—KE6T	—4,995
Hirofumi Kondo	—JF2PZH	—4,725

Single-Operator Category—10 Meters

James Sladek	—WB4UBD	—1,890

Multi-Operator Category—All Bands

Mike Bottema	—K8EX	—166,950
Pasquale Ventresca	—WB3FIZ	—102,225
Radioklub PRI	—OD1PM	—70,725
Leicester Polytech	—G3SDC	—65,995
Greg Haines	—WB4PRU	—48,900
Radioklub Zvazarm	—OK3KGI	—42,380
Radioklub	—OK3KYR	—30,140
Guernsey ARC	—GU3HFN	—12,025
Radioklub Murgasa	—OK3KJF	—6,800
Central Radioklub	—OK3KFV	—5,500

Multi-Operator Category—20 Meters

Sodermans Regemente	—SL5AR	—61,920

Check Logs: N6ELP, WB6AQR, Y25DL, F6AUS

phone only. (B) multi-operator, single transmitter, phone only.

EXCHANGE:

Stations within the contiguous 48 US states and Canada transmit RS report and state or province/territory. All others transmit RS report and DX country.

POINTS:

5 QSO points for contact with W/VE stations contacted within the contiguous 48 US states and Canada. All other contacts earn 10 points each.

MULTIPLIERS:

1 multiplier point will be earned for each of the contiguous US states (48 maximum—a District of Columbia contact may be substituted for a state of Maryland multiplier), each of the Canadian provinces/territories (13 maximum), and each DX country outside the contiguous 48 US states and Canada.

FINAL SCORE:

Total QSO points times total multiplier points equals claimed score.

CONTEST ENTRIES:

Each entry must include log sheets, a dupe sheet for 100 or more contacts, a contest summary, and a multiplier check sheet.

ENTRY DEADLINE:

All entries must be postmarked no later than February 20, 1985.

DX WINDOW:

Stations are expected to observe the DX window from 1.825–1.830 MHz as mutually agreed by Top-Band operators. Stations in the US and Canada are asked not to transmit in this 5-kHz segment of the band. During the contest all W/VE stations are requested to utilize only those frequencies from 1.808–1.825 and 1.830–1.900 MHz.

DISQUALIFICATIONS:

Disqualification may result if contestants omit any required entry form, operate in excess of legal power authorized for the given area, manipulate operating times to achieve score advantage, or fail to omit duplicate contacts which would reduce the overall score more than 2%. Decisions of the contest committee are final.

AWARDS:

Contest awards will be issued in each entry category in each of the contiguous 48 US states, each Canadian province/territory, and each DX country. A minimum of 100 QSOs must be worked to qualify.

CONTEST ADDRESS:

To obtain information or entry forms, or to submit a contest entry, forward an SASE to: 160-Meter Contest, Harry Arsenault K1PLR, 603 Powell Avenue, Erie PA 16505.

1ST ANNUAL 15-METER WORLD SSB CHAMPIONSHIP 0000Z to 2400Z January 26

SPONSORED BY:

73: Amateur Radio's Technical Journal.

MISCELLANEOUS RULES:

Work as many stations as possible on 15-meter phone during the specified times of allowable operation. Stations may be worked once. Crossmode contacts will not count. Single-operator stations may operate a total of 16 hours. All multi-operator stations may operate the entire 24-hour period. Off periods must be noted in your logs and on your summary sheet. Off periods are *no less than 30 minutes each.*

OPERATOR CLASS:

(A) single-operator, single transmitter, phone only. (B) multi-operator, single transmitter, phone only.

EXCHANGE:

Stations within the contiguous 48 US states and Canada transmit an RS report and state, province, or territory. All other stations, including Alaska and Hawaii, transmit RS report and DX country.

POINTS:

5 QSO points for contact *within* your continent. 10 QSO points for contact *outside* your continent. List points for each contact on your log sheets.

MULTIPLIERS:

1 multiplier point is earned for each US state (48 maximum—a District of Columbia contact may be substituted for a state of Maryland multiplier), each Canadian province or territory (13 maximum), and DX country (excluding the contiguous US and Canada).

FINAL SCORE:

Total QSO points times total multiplier points equals claimed score.

CONTEST ENTRIES:

Each entry must include a contest log, a dupe sheet, a contest summary, and a multiplier checklist. We recommend contestants send for a copy of the contest forms. Enclose an SASE to the contest address listed below.

ENTRY DEADLINES:

All entries must be postmarked no later than February 26, 1985.

DISQUALIFICATIONS:

Omission of any required entry form, operating in excess of legal power, manipulating of contest scores or times to achieve a score advantage, or failure to omit duplicate contacts which would reduce the overall score more than 2% are all grounds for immediate disqualification. Decisions of the contest committee are final.

AWARDS:

Contest awards will be issued in each operator class in each of the contiguous 48 US states, Canadian provinces and territories, and each DX country represented. A minimum of 100 QSOs must be worked to be eligible for contest awards.

CONTEST ADDRESS:

To obtain entry forms or to submit an entry, forward an SASE to: 15-Meter Contest Chairman, Bill Gosney KE7C, 2665 N. Busby Rd., Oak Harbor WA 98277.

1ST ANNUAL 20-METER WORLD SSB CHAMPIONSHIP 0000Z to 2400Z January 27

SPONSORED BY:

73: Amateur Radio's Technical Journal.

MISCELLANEOUS RULES:

Work as many stations as possible on

20-meter phone during the specified times of allowable operation. Stations may be worked once. Crossmode contacts will not count. Single-operator stations may operate a total of 16 hours. All the multi-operator stations may operate the entire 24-hour period. Off periods must be noted in your log(s) and on your summary sheet. Off periods are *no less than 30 minutes each.*

OPERATOR CLASSES:

(A) single-operator, single transmitter, phone only. (B) multi-operator, single transmitter, phone only.

EXCHANGE:

Stations within the 48 contiguous US states and Canada transmit an RS report and state, province, or territory. All other stations, including Alaska and Hawaii, transmit RS report and DX country.

POINTS:

5 QSO points for contact *within* your continent. 10 QSO points for contact *outside* your continent. List points for each contact on your log sheets.

MULTIPLIERS:

1 multiplier point is earned for each US state (48 maximum—a District of Columbia contact may be substituted for a Maryland multiplier), each Canadian province or territory (13 maximum), and DX country (excluding the contiguous US and Canada).

FINAL SCORES:

Total QSO points times total multiplier points equals claimed score.

CONTEST ENTRIES:

Each entry must include a contest log, a dupe sheet, a contest summary, and a multiplier checklist. We recommend that contestants send for a copy of the contest forms. Enclose an SASE to the contest address listed below.

CONTEST DEADLINE:

Each entry must be postmarked no later than February 27, 1985.

DISQUALIFICATIONS:

Omission of any required entry form, operating in excess of legal power, manipulating of contest scores or times to achieve a score advantage, or failure to omit duplicate contacts which would reduce the overall score more than 2% are all grounds for immediate disqualification. Decisions of the contest committee are final.

AWARDS:

Contest awards will be issued in each operator class in each of the contiguous 48 US states, Canadian provinces and territories, and each DX country represented. A minimum of 100 QSOs must be worked to be eligible for contest awards.

CONTEST ADDRESS:

To obtain entry forms, or to submit an entry, forward an SASE to: 20-Meter Contest Chairman, Chuck Ingram WA6R, 44720 N. 11th St. E, Lancaster CA 93535.

AWARDS

Bill Gosney KE7C
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

THE AWARDS PROGRAM OF *73: AMATEUR RADIO'S TECHNICAL JOURNAL*

It's hard to believe the years which have passed since our initial announcement of the now famous *73* Awards Program portfolio. Since its introduction by yours truly, KE7C, in 1979, we've seen the program grow to become one of the most popular challenges facing amateurs today!

Consisting of six domestic and five DX operating achievements, the program has captured the interest of many of our fellow amateurs, rag-chewers, DXers, and contesters alike.

How does *73* process award applications? Upon receipt of an application, each entry is carefully scrutinized for authenticity. They must be sent to the Awards Manager in the proper format (as noted in the award rules), otherwise they must be returned to the applicant.

If approved, a work sheet is prepared. A copy is sent to *73* headquarters to process your certificate. It is there that your award is given a personal touch and later mailed to your door. (A copy of the work sheet is also mailed to the applicant at the same time to acknowledge receipt of the application.)

Should an applicant feel it is necessary to follow up on an application, send your inquiry to: *73*, Award Certificate Processing Department, 80 Pine Street, Peterborough NH 03458, USA. Always enclose a stamped business-size envelope with your letter.

We hope you enjoy the challenges of the *73* Awards Program. We ask that you share it with your amateur friends.

While we hope you'll pursue these awards, we also ask that you send the Awards Manager any information you might have on other awards which have never appeared between the covers of this magazine. Our files are getting bare, and it is the input of our readers that keeps the image of this column original and creative! If your club sponsors an award, why not share it with our readers throughout the world?

Now here are the six domestic awards being sought after by award seekers throughout the world. These awards are not meant to be an overnight venture, nor were they designed to duplicate any in existence today. Each offers its own degree of difficulty and creates a sense of accomplishment in those who are happy recipients. Next month we'll feature our five DX awards.

THE Q-5 AWARD OF EXCELLENCE

If you frequent the American Novice bands, you will be pleased to learn of an award exclusively for this portion of the spectrum. This award is not meant to be an overnight accomplishment. Stations meeting the challenge of this award will be proud to display it in their shack. It depicts the excellence and superiority of their station's transmitted signal as it is heard throughout the various US call districts.

1. The Q-5 Award is available to licensed amateurs and SWL stations throughout the world!

2. To qualify, applicants must work all ten US call districts and receive no less than a Q-5 readability report. A valid RST might be 599, 579, 549, etc., while an RST of 459, 449, or 469 would not qualify.

3. To be valid, all contacts must be made operating CW on those frequencies assigned the American Novice. Contacts must be made on or after January 1, 1979.

4. There are no band restrictions; applicants may request special band endorsement, however, at the time application is made.

5. To apply, prepare a list of claimed contacts, logging each one in order by the US call district worked. Include the station callsign, date and time in GMT, the frequency, and most important, the RST as noted on the confirmation card.

6. *Do not send QSL cards*! Have your list verified by two amateurs or a notary public.

7. Award fee is $5.00 in US funds (no IRCs or foreign currency). Checks written on foreign banks must be payable in US funds.

8. Forward your application and award fee to: Bill Gosney KE7C, *73* Awards Manager, 2665 N. Busby Road, Oak Harbor WA 98277, USA.

AWARD RECIPIENTS
(as of 9-1-84)
Q-5 AWARD OF EXCELLENCE

115.	VQ9JW	133.	VE4AKN
116.	VE3-9094	134.	KA2RIT
117.	W3RZD	135.	WD4CNZ
118.	WA1TBV	136.	N8FBY
119.	KA0NPR	137.	KA9QYA
120.	KA2OMX	138.	KA0RLR
121.	KA5JYL	139.	KA0QMP
122.	KA4WYA	140.	KC4UB
123.	KA8SNN	141.	KA9ISV
124.	KA6SOC	142.	KA0QEA
125.	WD0AVG	143.	KA3FHV
126.	WD8BKE	144.	KA2RSH
127.	WD9GYX	145.	KA9OKV
128.	KB4BSO	146.	WH6AVA
129.	KA2GSD	147.	KA5RNH
130.	DA1WJ	148.	VE5ADO
131.	KB4GYC	149.	LU1CLA
132.	WB3LHY	150.	KA9HKB

CENTURY CITIES AWARD

Designed as a dual worked-all-states effort, the editors of *73* present the Century Cities Award. The applicant who has earned this recognition has accomplished probably the greatest feat available in WAS award programs.

1. This award is available to licensed amateur and SWL stations throughout the world.

2. All contacts must be made on or after January 1, 1979, to be valid.

3. To qualify, the applicant must work and confirm a minimum of two cities or towns in each of the fifty (50) US states, for a total of 100.

4. To apply, prepare a list of contacts in alphabetical order by state. Include the callsign, the date and time of the contact in GMT, the band, and the city. Your list would look something like the following. First line, five columns: Alabama KA4ZZZ 4/30/84 7 MHz Decatur; second line, last four columns: W4MKU 11/15/82 21 MHz Huntsville; third line, five columns: Alaska KL7MI 5/16/83 14 MHz Anchorage, and so on.

5. *Do not send QSL cards*! Have your claimed contact list verified by two amateurs or a notary public.

6. Award fee is $5.00 in US funds. Do not send IRCs or foreign currency as they are no longer acceptable. Checks written on foreign banks must be payable in US funds.

7. Forward your application and award fee to: Bill Gosney KE7C, *73* Awards Manager, 2665 N. Busby Road, Oak Harbor WA 98277, USA.

AWARD RECIPIENTS
(as of 9-1-84)
CENTURY CITIES AWARD

39. K9LJP
40. KA9LYH
41. HC2RG
42. PY2DBU
43. KX5U
44. WA8BIJ
45. KA6OGC
46. W9JBR

SPECIALTY COMMUNICATIONS ACHIEVEMENT AWARD (CLASS A)

1. Available to licensed amateurs and SWL stations throughout the world, this award requires that all contacts be made on or after January 1, 1979.

2. Only communications via SSTV, RTTY, EME (Earth-moon-Earth), and/or OSCAR satellites will be recognized for this award. Contacts between stations on OSCAR and EME may be made using any authorized mode allowed in your country. Mixed-mode contacts are not valid.

3. To qualify, applicants must work and confirm contact with each of the 50 US states. There are no band requirements. Specific band accomplishments will be recognized, however, if requested at the time application is made.

4. To apply, the applicant must prepare a list of claimed contacts in alphabetical order by state. Include the date and time in GMT, the band and mode of operation, and a description of the equipment and antenna system used.

5. *Do not send QSL cards*! Have your list verified by two amateurs or a notary public.

6. Award fee is $5.00 in US funds only. Sorry, we cannot accept IRCs or foreign currency.

7. Forward your application and award fee to: Bill Gosney KE7C, *73* Awards Manager, 2665 N. Busby Road, Oak Harbor WA 98277, USA.

AWARD RECIPIENTS
(as of 9-1-84)
TEN-METER 10-40 AWARD

1. W6OLA/7
2. K4JSI/6

TEN-METER 10-40 AWARD

What would an awards program be without a stateside QRP incentive? Designed especially for owners of converted CB equipment, the 10-40 award is probably the roughest worked-all-states award in existence. If you don't believe it, ask those who've tried numerous times and failed!

AWARD RECIPIENTS
(as of 9-1-84)
ANNUAL WORKED ALL USA AWARD

Mixed Band
86. KA7MPJ
87. KA9JJK
88. VE7EIK
89. N4HPX
90. I0AOF(RTTY)
91. I0AOF(CW)
92. KI2G
93. PY1DWM
94. YB2BLI(RTTY)
95. VP2MO
96. KA6OGC
97. KA2PHQ
98. KX5U

6 Meters
6. K3HFV
7. N4QH
8. N5DDB
9. N9CEX
10. K4GOK
11. W4CKD

10 Meters
7. N4QH
8. N5CSW
9. KA9HVV
10. VE2FOH
11. HI3VAK

15 Meters
4. WB6CDM
5. KA4IFF
6. WB9UKS
7. N4QH
8. WB7VBQ
9. KA6SOC

20 Meters
10. KA0INF
11. KA9JOL
12. KE7C
13. KC4YY
14. WA0CEL
15. KA4OOU
16. KA9LYH
17. WA9AEA
18. JH8NYK

30 Meters
1. K3WGA

40 Meters
3. WD4DBJ
4. WD0BOS
5. N5AHZ
6. N4QH
7. KA1DNB
8. K4NRR

80 Meters
10. WB2ZEL
11. K9LJP
12. KI4Y
13. KQ7Y
14. K3KCY
15. WB9YUH

160 Meters
1. KC8P

1. This award is available to licensed amateurs and SWL stations throughout the world.

2. To be valid, all contacts must be made on the ten-meter band using only converted CB equipment or other low-power (20 Watts output or less) commercial gear. External amplifiers are prohibited. Contacts must be made on or after October 1, 1978, on AM, SSB, CW, or FM. Crossmode contacts will not count.

3. To qualify, applicants must work and confirm at least forty (40) US states.

4. To apply, list contacts made in alphabetical order by US state beginning with Alabama. Include the call of the station worked, the date and time in GMT, the mode of operation, and a brief description of the equipment and antenna system utilized to make the contacts.

5. *Do not send QSL cards*! Have your list verified by two amateurs or a notary public.

6. Award fee is $5.00 in US funds. IRCs or foreign currency are not acceptable. Checks written on foreign banks must be in US funds.

7. Forward your application and award fee to: Bill Gosney KE7C, *73* Awards Manager, 2665 N. Busby Road, Oak Harbor WA 98277, USA.

ANNUAL WORKED ALL USA AWARD

1. If you're looking for a stateside award with a challenge, this one is definitely the one. The annual Worked All USA Award is available to licensed amateurs and SWL stations throughout the world.

2. To qualify, applicants must work each of the fifty (50) US states within the same calendar year (January 1 through December 31). Annual endorsements will be awarded each subsequent year that an applicant qualifies again.

3. All valid contacts must be made on or after January 1, 1979. There is an award for single-band accomplishments on 2, 6, 10, 15, 20, 30, 40, 75, and 160 meters. A mixed-band award is also available.

4. To apply, prepare a list of claimed contacts in alphabetical order by state. List the state, the callsign of the station worked, the date and time in GMT, and the band and mode of operation.

5. *Do not send QSL cards*! Have your list of contacts verified by two amateurs or by a notary public.

6. The fee for this award is $5.00 in US funds. Annual endorsements are $2.50. We are sorry, but we can no longer accept IRCs or foreign currency. Checks written on foreign banks must be payable in US funds.

7. Forward you application and award fee to: Bill Gosney KE7C, *73* Awards Manager, 2665 N. Busby Road, Oak Harbor WA 98277, USA.

AWARD RECIPIENTS
(as of 9-1-84)
DISTRICT ENDURANCE AWARD

8. XE1TIS (49 MIN)
9. K0WNY (52 MIN)
10. KE7C (14 MIN)
11. KA3FUU (50 MIN)
12. SV1GJ (42 MIN)
13. OK2QX (56 MIN)
14. KA0MMD (39 MIN)
15. I5MXX (18 MIN)
16. P29NSF (28 MIN)
17. VE5ADO (51 MIN)

DISTRICT ENDURANCE AWARD

If any of our readers feel our awards are too easy, take a hard look at this award! Looks simple, huh? Don't be deceived. Try pursuing it; it will drive you right up the wall with frustration. Known as the District Endurance Award, you'll need to find yourself an accurate timepiece, as you'll have exactly sixty (60) minutes to work all ten (10) US call districts. If you surpass the time limit, you'll have to start all over again. It definitely takes some planning, perhaps even some band changing.

Oh, one last important point. All contacts must be made independent of nets, any net-type operations, and not while a contest is underway! Any takers?

1. The District Endurance Award is available to licensed amateurs and SWL stations worldwide.

2. To be valid, all contacts must be made on or after January 1, 1979. There will be no band or mode restrictions. If you are fortunate to work all contacts on a single band, however, we will be happy to recognize that feat should you mention it at the time application is made.

3. To qualify, applicants must work all ten (10) US call districts in one hour or less. The time will commence the moment the first contact is established (callsign and RST are exchanged) and end the moment the 10th call-district contact is made. Call districts can be worked in any order so long as all ten districts are worked within the 60-minute period.

4. To apply, applicants must state in their applications that all contacts were made independent of net or contest operation. Applicants must prepare a list of claimed contacts in callsign order by district. Include the date and time in GMT, the band and mode of operation, and the state.

5. *Do not send QSL cards*! Have your claimed list of contacts verified by two amateurs or a notary public.

6. Award fee is $5.00 and must be payable in US funds (no IRCs or foreign currency). Checks written on foreign banks must be payable in US funds.

7. Forward your application and award fee to: Bill Gosney KE7C, *73* Awards Manager, 2665 N. Busby Road, Oak Harbor WA 98277, USA.

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73 INTERNATIONAL

from page 60

Activity—Band Usage

On the HF bands, 40, 20, 15, and 10 meters, an average of 40% were active; 160m attracted 7%, and the new 30m band just under 5%. (This band has been available for only about 12–18 months.) At VHF and above, 4.4% operated on 6m, just over half (51%) are active on 2m, 6.4% on 70cm, and an average of 0.3% on all other bands above 70cm. Good intentions were always indicated by an average of 15% for future HF activity (presumably by way of upgrading), 11% moving up to 70cm, and 2% indicated future use of frequencies above 432 MHz.

Time Spent on Hobby

"Gilding the lily" should have been included in this section because the time the average radio operator spent at the hobby was 48.4 hours per week! No wonder some XYLs and possibly a few OMs growl now and then. The average figures given are in Fig. 3.

A rewording of the question in this section is necessary, as it is known that all individual amateurs do not participate in all these activities in any one given week, but it still is an interesting result when viewed with circumspection.

How Introduced to Amateur Radio

Personal contact with friends or relatives accounted for over 63% of the introductions to amateur radio. Just under 21% came via shortwave listening, and only 7% resulted from Branch/club activity, which was on a par with those who first read about the hobby.

How Long Before Ambition to Become an Amateur was Realized

In the age group up to 40 years it took, on average, just over a year to get a license after being infected by personal contact with another amateur at school, at work, or within the family. At the other end of the age scale, first exposure to amateur radio came through the armed forces or personal contact, and it took another seven years to get a license.

Conclusions

There is a lot to be learned from the survey, not the least being the way the questions are phrased. Figures are also required about satellite operations, packet radio, use of computers in amateur radio, and so on. Several surveys will be necessary before trends can be seen properly, but at least the completion of this, the first one, is a start to help with the planning for the future of amateur radio here in ZL.

VHF ACTIVITY FROM NIUE ISLAND

Six-meter beacon—ZK2SIX—52.100 MHz—antenna at present, an 800' long rhombic at 80' high, but it is only temporary. . . another antenna is to be built that will be a bit more omnidirectional and can be attached permanently to the beacon. The beacon was put up by Bob Sutton ZK2RS, and he reports the life of the beacon is uncertain after his departure from the island in November or December this year when he returns to ZL.

Warrick ZL8AFH, Raoul Island, finished his tour of duty there and left the island late in August. His replacement is not an amateur licensee, so once again Raoul Island goes QRT for an indefinite period.

Ages	Percent
10–19	1.22
20–29	6.51
30–39	16.32
40–49	20.28
50–59	22.77
60–69	21.4
Over 69	11.5

Fig. 1.

DX QSL TIP

Ron K6OZL, who recently operated from Northern Cooks as ZK1XL, reports: When sending QSL cards to areas where it is hot and humid, put a piece of waxed paper under the flap of the self-addressed envelope you send. Out of 2500 cards he received, 2495 were stuck shut by the humidity! The other five had waxed paper under the flap.

OLD TIMERS CLUB

This is the ZL equivalent of the Quarter Century Wireless Association. Certificates were awarded to Jack Ashford ZL2RO, Graham Goodger ZL2RP, Lou Smith ZL4BF, and Bill Turner ZL1PY recently for their long association with amateur radio.

Silent keys recorded this month were Len Chisholm ZL3UK, Pat Senior ZL3VQ, and Roger Bacon ZL1SG, all long-serving amateurs and members of the OTC.

As this column, by my calculations, will appear in the December issue of *73*, I wish to thank all those who have written to me regarding the ZL scene and extend to all *73* readers and staff the best of festive greetings from all here down under in ZL-land and a very Happy Christmas. I hope Father Christmas brings you all something good for the shack on Christmas morning; I'll be thinking of you all on that special day.

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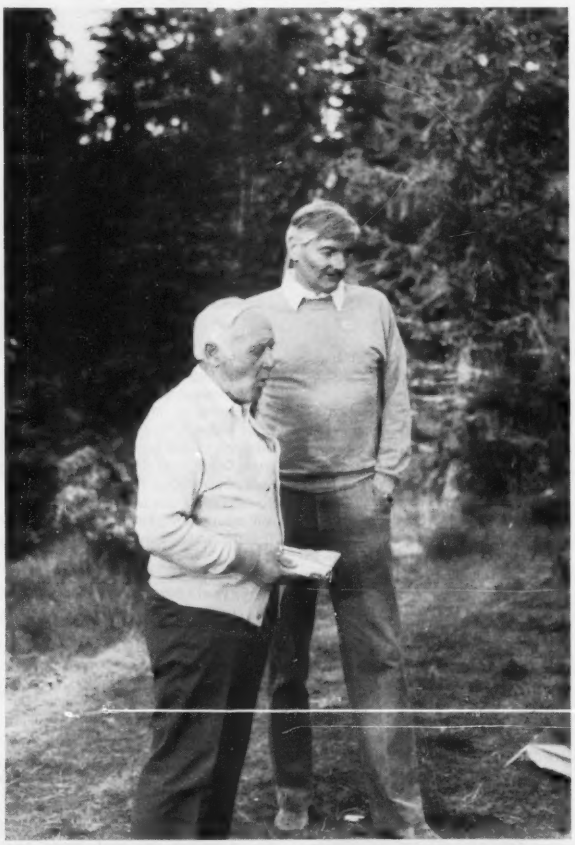
10,000		0.15
More		1.40

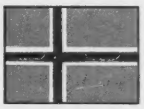
Fig. 2.

Activity	Time (Hours per week)
Equipment	
Operating	7.7
Design	6.3
Construction	7.3
Reading	
Magazines	8.0
Books	7.0
Club Activity	5.6
Other Activity	6.5

Fig. 3.



Wilfred LA6SL and Knut LA9YF, the editor of Amateur Radio *and a member of the HQ staff of NRRL.*



NORWAY

Bjorn-Hugo Ark LA5YJ
N-3120 Andebu
Norway

Well, hi there, fellows, hope you enjoyed my last column, because here I am again, this time with a newcomer in the Norwegian amateur-radio meetings, The Skumsjoe Treff-84, the first of what I sincerely hope will be an annual meeting, because this was something new.

Only a week after our hasty return from HAM-84 in southern Germany, described in November's *73*, we had the opportunity and great pleasure to attend another ham meeting, held in the central part of Norway. Up in the mountains, it was close to an idyllic lake, the Skumsjoe Lake, surrounded by some low hills between the two cities of Raufoss and Gjoevik. Because of lack of time and some unfortunate bad weather which hit the whole area *except* this specific spot, not too many did attend, but with the results being as they were, I'm sure the number next year will be quite another story.

I must say that such a cozy meeting will never be forgotten. The program was arranged so as to get as many as possible of the hams to bring their families with them and just enjoy themselves. The ham-radio shop, Norsk Radio Supply, showed up on very short notice with an exhibition of the latest from Yaesu Musen, Telex Hy-Gain, Cushcraft, etc., and the more than 50 amateurs there had a super time seeing and touching the newest technology in ham radio. Normally, they have to travel from 2–4 hours to get to Oslo, where the shop is situated. The arrangement was made by the local section of NRRL, the Gjovik group, and one of the main goals was to get as many as possible of the local CB clubs to attend and introduce them to ham radio; I understand this was a total success and guess that we are going to get quite a few new hams from that area in the future.

Saturday night had the big feature, with a barbeque with a whole pig being roasted, dancing to music produced live by Wilfred LA6SL, amateurs chatting, wives and kids doing more or less the same, except for the few Vikings taking a bath in 14-degree-Celsius water—the author absolutely *not* included! But mind you, the pig was delicious. Knut LA9YF (maybe our new president) was attending on behalf of the HQ of NRRL and gave an informative speech to the CBers.

On Sunday there was a fox-hunting competition, with quite a few newcomers; to be honest, most of us were, including myself, and I did hear the foxes but I never saw one.

DX

My last column didn't give you any information on DX since I haven't been active at all for over a month. This is just due to too much work and traveling. Another thing is that I have moved my QTH and I can assure you that my new QTH absolutely is not the DXers dream. Later I will

give you a description of my old setup and, of course, the new one. I must say that I'm more curious than desperate about how I will manage to work any new ones at all, because those mountains will surely be a challenge to work DX over. In the meantime, you must be satisfied with reading my presentations on other DXers, who have the opportunity to work them all.

Bjorn Waller SM6EHY

One of the well-known low-band DXers in Scandinavia is Bjorn Waller SM6EHY of Hindas, Sweden. He has been one of those you always hear working the rare ones, either on 80 or 160 meters; the latter seems to be of most interest to him recently.

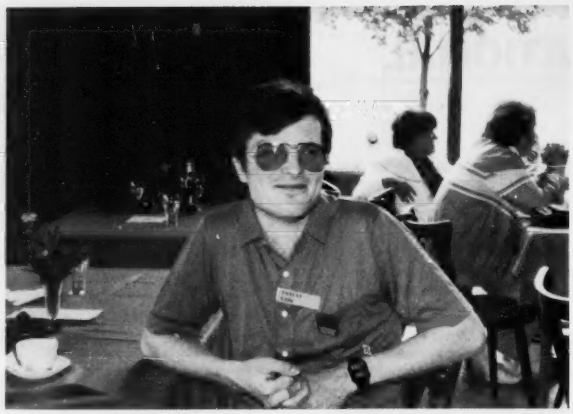
I had the opportunity to run into Bjorn at HAM-84 at Friedrichshafen, and it was an unforgettable moment. You may ask, why? Well, it's very seldom you are able to meet someone with such identical interests as yourself. Antennas, propagation, and low-band DXing. It's one of the rare times you always will remember. And a new friendship has been made. We had, of course, met on the air, but I think we were chatting for two hours each of the two days I was there.

Bjorn is a nice looking fellow, born in 1956 and first licensed in 1971. He's unmarried and lives with his parents in a nice villa, 35 km east of Goteborg in southern Sweden, facing a large lake. He got interested in DXing when someone told him about the possibility of working it on 80 meters, in the winter of 1976, and since then he's been really bitten by the bug. His recent DXCC status is 138 mixed and 132 CW, all on 80 meters. But he told me that he has 240 worked, all CW, all on 80 meters, and, believe it or not, 103 worked on CW on 160 meters. Remember, it was only last year that the Swedes got permission to work on 160 meters. His antenna on 160 is a 1/4-wave sloper up 30 meters above a large ground system with some 200-meter-long radials.

On 80 meters he runs a 4-element phased vertical beam with 400 radials, and having as much space as he has, he is running quite a few Beverage antennas stretched 3 meters above the ground. As he says, a total of some 23 km of wire. Wonder what the neighbors say? Or what about living in a bird cage? Hi! Anyway, he's a marvelous DXer on low bands, and watch out guys, he is really going to hit hard on the higher bands, as well. Up till now he has been running a dipole on 10 and 15 meters and a ground plane on 20 meters, but look at what he has going now: a 39-meter tower, rotatable, with stacked yagis, 6 over 6, on 20, 15, and 10 meters; on 40 meters, a 3-element yagi, but it's possible he will try a 2 over 2 instead. I sincerely wish him luck.

Bjorn SM6EHY is also very well known as an active 2-meter ham, working EME, tropo, sporadic E, and aurora; he is really keeping the air glowing with rf. His rig is, of course, a TR-7 and 4B-line all made by R. L. Drake Company, and he runs a homebrew linear amplifier giving the legal power. And if this is not enough, he is even a high-speed CW operator as well. So I really wonder, this does not sound very amateur-like. It's quite professional radioing.

Bjorn is always happy to QSO with DX; if you hear him, get yourself a schedule for an EME or low-band QSO. Where the DX is, he is. SM6EHY will surely be one of those big, big signals out of Europe, and I bet he will be hard to beat in a contest. Maybe the Finns (OHs) have some serious competition to come?



Bjorn SM6EHY at HAM-84, Friedrichshafen.

POLAND

Jerzy Szymczak
78-200 Bialogard
Buczka 2/3
Poland

ELECTORAL CAMPAIGN

At the end of 1984, deputies to the National Congress of PRAA will gather. They were elected by district conventions, including the district convention in Katowice on March 25th, where many members and invited guests heard a lecture by the outgoing board about organization troubles related to nearly two years of licensing difficulties.

It is to be regretted that so many former hams do not put in for licenses again. The first Polish UHF-FM repeater, resumption of transmitting of district bulletins, and rapid development of the radiotelephone networks were numbered among positive aspects of district activity. The chief of the repeater group and the initiator of the Polish QRP Club gave the final lecture.

A 10-person District Board, 6-person Auditing Committee, and 22 delegates to the National Congress were elected during the convention. New President SP9MM, new Vice-President SP9EU, and continuing Secretary SP9DL entered on their duties.

Before and during the convention an equipment exchange enabled many radio amateurs to purchase components and, for the first time, circuit boards for the locally-designed transceiver, "Bartek." On April 1st the district conventions of PRAA in Poznan and Bielsko Biala took place.

Discussed at the convention in Katowice was the first Polish UHF-FM repeater in Podzamcze, near Zawiercie, built by radio amateurs of the Clubs: SP9PDG in Dabrowa Gornicza, SP9PEZ in Katowice, SP9PPP in Bytom, and SP9PKD in Zawiercie. Chief constructors of the repeater were: Jerzy Wojciechowski SP9MCW, Jacek Ziemniak SP9CSW, and Zbigniew Sitko SP9-2841.

The automatically-controlled repeater, SR9E, works on channel R0 (input 145,000 kHz, output 145,600 kHz) with the power of the transmitter set at 1 W. Installation consists of three basic subassemblies: a receiver, a transmitter, and a control system. The control system includes the generator of the callsign SR9E and a system for repeater access controllable by the modulation tone of 1750 Hz. The device mates with two independent ground-plane antennas. A third antenna is being prepared for a radio beacon that would begin its work after a granting of permission. The radio beacon SP9VHE, emitting F2 with power of 100 mW, will be installed 504 meters above sea level to guarantee long range under good conditions. There are two independent diplexers between the antennas and the converter. In the future, the architects of the contraption will install more diplexers and use a common antenna for sending and receiving.

PORTUGAL

Luiz Miguel de Sousa CT4UE
PO Box 32
S. Joao do Estoril
2765 Portugal

As mentioned before, the new rules for the ham service came into force in July, 1983. However, thanks to the helpfulness of the Secretary of Communications, a commission was formed by five hams who will collaborate in review of the rules. The nominated hams are CT1VV, CT1BH, CT1WW, CT1AL, and CT1GM. We think that in the very near future we can really announce that we have rules according to the IARU Region 1 status.

I've received some letters from hams complaining of the delay in receiving QSLs via the Bureau. Despite other things written in several publications, The Portuguese QSL Bureau is in charge of R. E. P., Rede dos Emissores Portugueses (CT1REP). So send cards this way; the Bureau staff will take care of them with great care. They do handle cards almost daily.

VISITORS IN LISBON

This year, I have been very lucky meeting hams from several parts of the globe. Last July, Larry Lemas N6CCL and Wil LU6TEA (ex-CR6IK, CT4IK) came over to Portugal for their summer holidays and we had a short talk. Wil is my ex-neighbor in Africa, more precisely in Angola. Our thanks, and keep coming to this sunny European garden.

HAMS OVER THE CLOUDS

Celebrating the 32nd anniversary of the F.A.P.—Forca Aeria Portuguesa (the Portuguese Air Force) and taking an opportunity to promote this lovely hobby, two aeronautical mobile stations were active from two different airplanes. CT1CUG (Colonel Afonso), CT1GI (Lieutenant Colonel Brogueira), and CT4OA (Captain Leonel) were involved in this act. This operation had the support of the High Command, and the event was very well accepted by the hams and local authorities who issued the aeronautical mobile license. They send a nice award and QSL card for those who contacted them. The callsign used by them was CT7FAP/AM.

The planes were a Hercules C-130 and an Aviocar, and they handled the operation on their regular flights. On VHF, an ICOM 255E was used, and on HF they had a Kenwood TS-120S. These two operations were on the air for about a week, and nearly 13 flight hours were totaled. As a result, 750 contacts were made, with almost all European countries, Africa, and North and South America. For those who made contact and wish to receive a QSL card or award, you should send a QSL to: Comando Operacional da Forca Aeria, Monsanto, 1500 Lisboa, Portugal.

Last summer, I decided to go to Algarve (southern Portugal) and get some tropical weather down there. As a result, I had a nice chat with Edy G5BBD (known as the BBD of London, HI), and I stayed 5 days with him.

Does anyone know the new address for W8CNL? If you do, drop me a line.

Finally, I do wish you a very happy and prosperous 1985, and let's look for the DXpeditions in the New Year coming.

SAUDI ARABIA

Don Muhl WA0DEI (HZ1AB)
PO Box 2445
Dhahran
Saudi Arabia

For some time now, several of us have been watching the "73 International" column in *73* for a report on Saudi Arabia. In the past several months the column has expanded to include many new countries, so several of us got together and prepared this for you. We have been quite candid and no names are listed, even those of our Saudi amateur friends, so that no one gets in trouble.

YES, AMATEUR RADIO IS ALIVE IN SAUDI ARABIA

Many amateurs worldwide have the misinformed idea, primarily from contact with the ARRL, that amateur radio doesn't exist in Saudi Arabia. This is quite far from the truth, but the curtailment of amateur radio in the Kingdom is supported by the strict rules imposed on those who do receive the right to operate. At present there are only 19 legally-licensed Saudi operators, one club station, and four non-Saudis. The last amateur-radio license was granted by the King in 1974. "Licensed" is possibly the wrong word; "decreed" would be better. There is no formal written amateur-radio license, only a letter signed by the King or one of the Royal Family Princes that allows the user to acquire equipment and then operate. Those granted such a decree then choose their own callsign in the HZ1 grouping if Saudi or in the 7Z1 grouping if non-Saudi.

Even though the Ministry of Post, Telephone, and Telecommunications (MOPTT, or PTT for short) is responsible for all radio communications, amateur operation is outside of their purview. PTT and the military only monitor the amateur operations for illegal or unauthorized usage. An example of unauthorized usage would

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be to talk with any amateurs in any communist country or, especially, Israel. Even a quick exchange of signal reports is not allowed. The Saudi monitoring system is so effective that it takes less than a one-minute transmission with a 1-Watt handheld radio for the PTT to pinpoint the user to within 100 meters and send the police if it is a non-authorized user.

Amateur operation is limited to the five main HF bands and 2 meters; however, the 2-meter operation is limited to two channels in the 167–170-MHz range. This is specifically done so that no conversations can take place across the borders of the Kingdom with neighboring countries.

In addition to the twenty-four "licensed" operators in the Kingdom, there are also some 250 or more amateurs from other countries living and working in Saudi Arabia. Those that live and work in the Dhahran area are most fortunate, as they may visit and operate the Aramco Club Station at Dhahran Airport. This club station still operates under a Royal Decree issued by the King to Aramco prior to 1974. Any amateur-radio operator who is working in Saudi Arabia or is able through work to obtain a business visa can make arrangements through the US Army Communications Command Officer in Charge at Dhahran and may operate the club station, HZ1AB. This station, although totally under US military control, must still abide by all rules pertaining to individual amateur operators. Any slip by visitors or members operating HZ1AB could cause its shut-down immediately.

Several foreign amateurs living in Riyadh, the capital of Saudi Arabia some 400 km inland from Dhahran, attempted to establish a second club station during the summer and fall of 1983. Their efforts were totally negated thanks to two American women, a Korean, and two German businessmen who were caught within the same three-month period trying to smuggle amateur equipment into the Kingdom. This is just the tip of the iceberg when it comes to imposing restrictions on anyone, not just amateurs using HF radio. A further example is that any HF receiver capable of copying sideband is also considered a contraband item and will be confiscated by customs officials. This applies to equipment used by foreign governments as well as businesses or private citizens.

But all is not lost; many foreign amateurs do operate and quite often from the stations of those individuals who are licensed. All it takes is the nerve to get an audience with one of the licensed Princes (by the way, all licenses are to members of the Royal Family or their employees), and the Prince OKs use of his HZ callsign and operation at his station. When the four foreign employees leave, it is doubtful if any new 7Z1 callsigns will be issued until the problems in the Middle East are solved. Once one has lived in Saudi Arabia, it is easy to understand why the Saudis are very skeptical and have imposed such harsh controls over amateur-radio operations and HF radio operations in general that are not associated with their government or military.

One of the ham stations equipped by and made available by the Saudi Arabian government.

The DXpedition station, BV0AB, in Taipei, July, 1984.

One of the nice things about amateur radio in Saudi Arabia is the background of the other amateur operators one meets. For instance, the only licensed female amateur in Pakistan is with her husband working for one of the major banks; two Americans in Riyadh each hold callsigns for over 21 different countries, and there are five husband-and-wife teams. Instead of radio contacts, the hams use the several computer mailbox systems that are in existence country wide.

This pretty well covers amateur operations in Saudi Arabia. For anyone coming here to work, remember there are no tourists, and for those workers who are amateurs, remember: (1) Don't bring any equipment of any kind, including a receiver capable of sideband operation, (2) don't expect to operate just because you have a license from another country, (3) don't advertise—you can end up in jail or be deported immediately, and (4) under no condition can women be permitted to operate except at the Dhahran Club Station.

If anyone is planning employment in the Kingdom and is going to the Eastern Province (Dhahran/Al-Khobar/Damman/etc.), contact the Officer in Charge, US Army Communication Center, APO New York 09616, Attn: MARS Station, and it may save later embarrassment. For those going to the capital, Riyadh, or to any other location such as Khamis, Taif, Tabuk, or Jeddah, contact AFLC/LSG-LCC, USAF MARS Station AJ3RY, APO New York 09038 for assistance. Just remember, *don't* bring any equipment into the country. If one does receive the approval to operate, the equipment used will be that of one of the Princes at his station.

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We're up to four now; possibly there will be two more to come in this year. Close cooperation between hams and local parties concerned show that we will have a good situation in amateur-radio activities.

The second Japanese group from JA6 was composed of the captain, JA6MS, and JA6VVS, JA6ERV, JA6GIP, JH6SOR, JE6MQW, JA5UIM/6, JF1JSP, and JH1IUN. They arrived in Taipei on July 21 and left on July 26. The trip was arranged in a hurry and their giant antennas were not received in time, so BV2A lent a 2-element tribander yagi and a 40/15-meter dipole.

Unfortunately, the weather in July was so terribly hot that the air conditioner in the operating room was of little help. Worse, radio propagation did not favor them. The callsign BV0AB was used on 7, 14, 21, and 28 MHz. Approximately 8,000 QSOs on CW and SSB were made, according to the group's statistics.

The above-mentioned late-arriving antennas consisting of a TA-351 5-element tribander yagi and a TD-3040 dipole finally arrived and were given to the CRA (China Radio Association) as a gift from the JARL. We are very appreciative of their generosity. We are also pleased to see the 2-inch callbooks of JA hams which were brought over by JA6MS and JA6VVS to a banquet given by the CRA. Mr. Chen, Division Chief of Ministry of Interiors, was asked to award a medal to both JA6MS and JA6VVS on behalf of the CRA to commemorate the special occasion and express appreciation.

Besides QSOs on the air, the Japanese were greeted by many visitors from abroad; among them were G4KLP, W9ZNY, OE3ALW, F6EXV, and JA1YDJ. Together with BV2A/BV2B, they and the representatives of the other countries talked for hours on the roof of the DXpedition station, BV0AB. Ken JA1YDJ was the captain of BV0JA and BV0YL, and he came back from Tokyo with an FT-757GX transceiver to be offered to CRA to add strength to stations in BV-land. He also brought us some copies of two popular magazines, *CQ* and *Mobil* (August issues), in which there were reports on the activities of BV0JA and BV0YL.

Although each expeditiion group did announce its QSL manager, there are still many QSL cards coming to us that we have to relay, causing considerable delay. In order to save time, here are the QSL managers: I2MQP/BV, I2NYN/BV, and I2BVS/BV via I2MQP; BV0AA via OH2BH, BV0JA and BV0YL via JG1QGT, and BV0AB via JH6SOR.

The coming expeditions (BV0W and BV0BG) will announce their QSL managers later.

As to the applications from interested DXpeditions, please be advised: apply for approval at least seven weeks ahead. It is necessary to include a detailed list of operators, licensed callsigns, the profession of each, and passport number (if available); also a list of equipment to be brought into this country stating manufacturer, model, serial number, power, frequency coverage, and numbers of transceivers or transmitters and receivers. Any omissions of the above will cause a delay in approval and call for unnecessary correspondence.

Furthermore, it is not recommended that you book your air passage before hearing from us. Owing to present facilities and limited manpower, we can allow only one expedition group in every two months. Therefore, overlapping applications will be denied or postponed. Last-minute applications can hardly be accepted.

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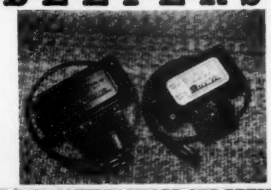

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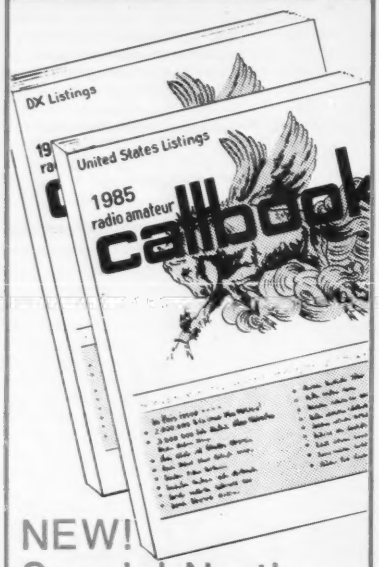

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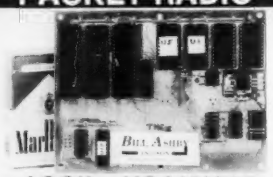

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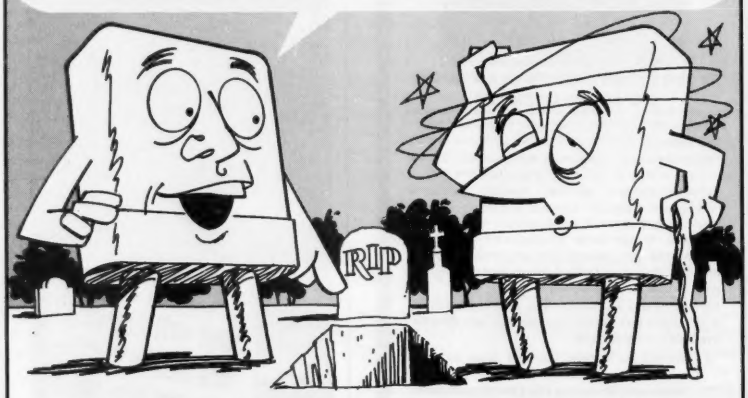

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4CX10000D/8171	1255.00	6293	24.00	6L6GC	5.03
4CX15000A/8281	1500.00	6326	P.O.R.	6CA7/EL34	5.38
4CW800F	710.00	6360/A	5.75	6CL6	3.50
4D32	240.00	6399	540.00	6DJ8	2.50
4E27A/5-125B	240.00	6550A	10.00	6DQ5	6.58
4PR60A	200.00	6883B/8032A/8552	10.00	6GF5	5.85
4PR60B	345.00	6897	160.00	6GJ5A	6.20
4PR65A/8187	175.00	6907	79.00	6GK6	6.00
4PR1000A/8189	590.00	6922/6DJ8	5.00	6HB5	6.00
4X150A/7034	60.00	6939	22.00	6HF5	8.73
4X150D/7609	95.00	7094	250.00	6JG6A	6.28
4X250B	45.00	7117	38.50	6JM6	6.00
4X250F	45.00	7203	P.O.R.	6JN6	6.00
4X500A	412.00	7211	100.00	6JS6C	7.25
5CX1500A	660.00	7213	300.00*	6KN6	5.05
KT88	27.50	7214	300.00*	6KD6	8.25
416B	45.00	7271	135.00	6LF6	7.00
416C	62.50	7289/2C39	34.00	6LQ6 G.E.	7.00
572B/T160L	49.95	7325	P.O.R.	6LQ6/6MJ6 Sylvania	9.00
592/3-200A3	211.00	7360	13.50	6ME6	8.90
807	8.50	7377	85.00	12AT7	3.50
811A	15.00	7408	2.50	12AX7	3.00
812A	29.00	7609	95.00	12BY7	5.00
813	50.00	7735	36.00	12JB6A	6.50

NOTE * = USED TUBE

NOTE P.O.R. = PRICE ON REQUEST

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"FILTERS"

COLLINS Mechanical Filter #526-9724-010 MODEL F455Z32F

455KHZ at 3.2KHz wide. May be other models but equivalent. May be used or new. $15.99

ATLAS Crystal Filters

5.595-2.7/8/LSB, 5.595-2.7/LSB
8 pole 2.7KHz wide Upper sideband. Impedence 800ohms 15pf In/800ohms 0pf out. 19.99

5.595-2.7/8/U, 5.595-2.7/USB
8 pole 2.7Khz wide Upper sideband. Impedence 800ohms 15pf In/800ohms 0pf out. 19.99

5.595-.500/4, 5.595-.500/4/CW
4 pole 500 cycles wide CW. Impedance 800ohms 15pf In/800ohms 0pf out. 19.99

9.0USB/CW
6 pole 2.7KHz wide at 6dB. Impedance 680ohms 7pf In/300ohms 8pf out. CW-1599Hz 19.99

KOKUSAI ELECTRIC CO. Mechanical Filter #MF-455-ZL/ZU-21H

455KHz at Center Frequency of 453.5KC. Carrier Frequency of 455KHz 2.36KC Bandwidth.
Upper sideband. (ZU) 19.99
Lower sideband. (ZL) 19.99

CRYSTAL FILTERS

NIKKO	FX-07800C	7.8MHz	$10.00
TEW	FEC-103-2	10.6935MHz	10.00
SDK	SCH-113A	11.2735MHz	10.00
TAMA	TF-31H250	CF 3179.3KHz	19.99
TYCO/CD	001019880	10.7MHz 2pole 15KHz bandwidth	5.00
MOTOROLA	4884863B01	11.7MHz 2pole 15KHz bandwidth	5.00
PTI	5350C	12MHz 2pole 15KHz bandwidth	5.00
PTI	5426C	21.4MHz 2pole 15KHz bandwidth	5.00
PTI	1479	10.7MHz 8pole bandwidth 7.5KHz at 3dB, 5KHz at 6dB	20.00
COMTECH	A10300	45MHz 2pole 15KHz bandwidth	6.00
FRC	ERXF-15700	20.6MHz 36KHz wide	10.00
FILTECH	2131	CF 7.825MHz	10.00

CERAMIC FILTERS

AXEL	4F449	12.6KC Bandpass Filter 3dB bandwidth 1.6KHz from 11.8-13.4KHz	10.00
CLEVITE	TO-01A	455KHz+-2KHz bandwidth 4-7% at 3dB	5.00
	TCF4-12D36A	455KHz+-1KHz bandwidth 6dB min 12KHz, 60dB max 36KHz	10.00
MURATA	BFB455B	455KHz	2.50
	BFB455L	455KHz	3.50
	CFM455E	455KHz +-5.5KHz at 3dB , +-8KHz at 6dB , +-16KHz at 50dB	6.65
	CFM455D	455KHz +-7KHz at 3dB , +-10KHz at 6dB , +-20KHz at 50dB	6.65
	CFR455E	455KHz +-5.5KHz at 3dB , +-8KHz at 6dB , +-16KHz at 60dB	8.00
	CFU455B	455KHz +-2KHz bandwidth +-15KHz at 6dB, +-30KHz at 40dB	2.90
	CFU455C	455KHz +-2KHz bandwidth +-12.5KHz at 6dB , +-24KHz at 40dB	2.90
	CFU455G	455KHz +-1KHz bandwidth +-4.5KHz at 6dB , +-10KHz at 40dB	2.90
	CFU455H	455KHz +-1KHz bandwidth +-3KHz at 6dB , +-9KHz at 40dB	2.90
	CFU455I	455KHz +-1KHz bandwidth +-2KHz at 6dB , +-6KHz at 40dB	2.90
	CFW455D	455KHz +-10KHz at 6dB , +-20KHz at 40dB	2.90
	CFW455H	455KHz +-3KHz at 6dB , +-9KHz at 40dB	2.90
	SFB455D	455KHz	2.50
	SFD455D	455KHz +-2KHz , 3dB bandwidth 4.5KHz +-1KHz	5.00
	SFE10.7MA	10.7MHz 280KHz +-50KHz at 3dB , 650KHz at 20dB	2.50
	SFE10.7MS	10,7MHz 230KHz +-50KHz at 3dB , 570KHz at 20dB	2.50
	SFG10.7MA	10.7MHz	10.00
NIPPON	LF-B4/CFU455I	455KHz +-1KHz	2.90
	LF-B6/CFU455H	455KHz +-1KHz	2.90
	LF-B8	455KHz	2.90
	LF-C18	455KHz	10.00
TOKIN	CF455A/BFU455K	455KHz +-2KHz	5.00
MATSUSHIRA	EFC-L455K	455KHz	7.00

SPECTRA PHYSICS INC. Model 088 HeNe LASER TUBES

POWER OUTPUT 1.6MW. BEAM DIA. .75MM BEAM DIR. 2.7MR 8KV STARTING VOLTAGE DC
68K OHM 1WATT BALLAST 1000VDC +-100VDC At 3.7MA $59.99

ROTRON MUFFIN FANS Model MARK4/MU2A1

115 VAC 14WATTS 50/60CPS IMPEDENCE PROTECTED-F 88CFM at 50CPS $ 7.99
105CFM at 60CPS THESE ARE NEW

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TYPE	PRICE	TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
2N1561	$25.00	2N5920	$ 70.00	40608 RCA	$ 2.48	BFY90	$ 1.50
2N1562	25.00	2N5921	80.00	40673 RCA	2.50	BLW60C5	15.00
2N1692	25.00	2N5922	10.00	40894 RCA	1.00	BLX67	12.25
2N2857	1.55	2N5923	25.00	60247 RCA	25.00	BLX67C3	12.25
2N2857JAN	4.10	2N5941	23.00	61206 RCA	100.00	BLX93C3	22.21
2N2857JANTX	4.50	2N5942	40.00	62800A RCA	60.00	BLY87A	7.50
2N2876	13.50	2N5944	10.35	62803 RCA	100.00	BLY88C3	13.08
2N2947	18.35	2N5945	10.00	430414/3990RCA	50.00	BLY89C	13.00
2N2948	13.00	2N5946	12.00	3457159 RCA	20.00	BLY90	45.00
2N2949	15.50	2N5947	9.20	3729685-2 RCA	75.00	BLY92	13.30
2N3118	5.00	2N6080	6.00	3729701-2 RCA	50.00	BLY94C	45.00
2N3119	4.00	2N6081	7.00	3753883 RCA	50.00	BLY351	10.00
2N3134	1.15	2N6082	9.00	615467-902	25.00	BLY568C/CF	30.00
2N3287	4.90	2N6083	9.50	615467-903	40.00	C2M70-28R	92.70
2N3288	4.40	2N6084	12.00	2SC568	2.50	C25-28	57.00
2N3309	4.85	2N6094	11.00	2SC703	36.00	C4005	2.50
2N3375	17.10	2N6095	12.00	2SC756A	7.50	CD1659	20.00
2N3478	2.13	2N6096	16.10	2SC781	2.80	CD1899	20.00
2N3553	1.55	2N6097	20.70	2SC1018	1.00	CD1920	10.00
2N3553JAN	2.90	2N6105	21.00	2SC1042	24.00	CD2188	18.00
2N3632	15.50	2N6136	21.85	2SC1070	2.50	CD2545	24.00
2N3733	11.00	2N6166	40.24	2SC1216	2.50	CD2664A	16.00
2N3818	5.00	2N6267	142.00	2SC1239	2.50	CD3167	92.70
2N3866	1.30	2N6304	1.50	2SC1251	24.00	CD3353	95.00
2N3866JAN	2.20	2N6368	30.00	2SC1306	2.90	CD3435	26.30
2N3866JANTX	3.80	2N6439	55.31	2SC1307	5.50	CD3900	152.95
2N3866JANTXV	4.70	2N6459	18.00	2SC1424	2.80	CM25-12	20.00
2N3866AJANTXV	5.30	2N6567	10.06	2SC1600	5.00	CM40-12	27.90
2N3924	3.35	2N6603	13.50	2SC1678	2.00	CM40-28	56.90
2N3926	16.10	2N6604	13.50	2SC1729	32.40	CME50-12	30.00
2N3927	17.25	2N6679	44.00	2SC1760	1.50	CTC2001	42.00
2N3948	1.75	2N6680	80.00	2SC1909	4.00	CTC2005	55.00
2N3950	25.00	021-1	15.00	2SC1945	10.00	CTC3005	70.00
2N3959	3.85	01-80703T4	65.00	2SC1946	40.00	CTC3460	20.00
2N4012	11.00	35C05	15.00	2SC1947	10.00	DV2820S	25.00
2N4037	2.00	102-1	28.00	2SC1970	2.50	DXL1003P70	22.00
2N4041	14.00	103-1	28.00	2SC1974	4.00	DXL2001P70	19.00
2N4072	1.80	103-2	28.00	2SC2166	5.50	DXL2002P70	14.00
2N4080	4.53	104P1	18.00	2SC2237	32.00	DXL3501AP100F	47.00
2N4127	21.00	163P1	10.00	2SC2695	47.00	EFJ4015	12.00
2N4416	2.25	181-3	15.00	A2X1698	POR	EFJ4017	24.00
2N4427	1.25	210-2	10.00	A3-12	14.45	EFJ4021	24.00
2N4428	1.85	269-1	18.00	A50-12	24.00	EFJ4026	35.00
2N4430	11.80	281-1	15.00	A209	10.00	EN15745	20.00
2N4927	3.90	282-1	30.00	A283	6.00	FJ9540	16.00
2N4957	3.45	482	7.50	A283B	6.00	FSX52WF	58.00
2N4959	2.30	564-1	25.00	A1610	19.00	G65739	25.00
2N5016	18.40	698-3	15.00	AF102	2.50	G65386	25.00
2N5026	15.00	703-1	15.00	AFY12	2.50	GM0290A	2.50
2N5070	18.40	704	4.00	AR7115	20.00	HEP76	4.95
2N5090	13.80	709-2	11.00	AT41435-5	6.35	HEPS3002	11.40
2N5108	3.45	711	4.00	B2-8Z	10.70	HEPS3003	30.00
2N5109	1.70	733-2	15.00	B3-12	10.85	HEPS3005	10.00
2N5160	3.45	798-2	25.00	B12-12	15.70	HEPS3006	19.90
2N5177	21.62	3421	28.00	BAL0204125	152.95	HEPS3007	25.00
2N5179	1.04	3683P1	15.00	BF25-35	56.25	HEPS3010	11.34
2N5216	56.00	3992	25.00	B40-12	19.25	HF8003	10.00
2N5470	75.00	4164P1	15.00	B70-12	55.00	HFET2204	112.00
2N5583	3.45	4243P1	28.00	BF272A	2.50	HP35821	38.00
2N5589	9.77	4340P3	18.00	BFQ85	2.50	HP35826B	32.00
2N5590	10.92	4387P1	27.50	BFR21	2.50	HP35826E	32.00
2N5591	13.80	7104-1	28.00	BFR90	1.00	HP35831E	30.00
2N5596	99.00	7249-2	10.50	BFR91	1.65	HP35832E	50.00
2N5636	12.00	7283-1	37.50	BFR99	2.50	HP35833E	50.00
2N5637	15.50	7536-1	30.00	BFT12	2.50	HP35859E	75.00
2N5641	12.42	7794-1	10.50	BFW16A	2.50	HP35866E	44.00
2N5642	14.03	7795	15.00	BFW17	2.50	HXTR2101	44.00
2N5643	25.50	7795-1	15.00	BFW92	1.50	HXTR3101	7.00
2N5645	13.80	7796-1	24.00	BFX44	2.50	HXTR5101	31.00
2N5646	20.70	7797-1	36.00	BFX48	2.50	HXTR6104	68.00
2N5651	11.05	40081 RCA	5.00	BFX65	2.50	HXTR6105	31.00
2N5691	18.00	40279 RCA	10.00	BFX84	2.50	HXTR6106	33.00
2N5764	27.00	40280 RCA	4.62	BFX85	2.50	J310	1.00
2N5836	3.45	40281 RCA	10.00	BFX86	2.50	JO2000	10.00
2N5842	8.45	40282 RCA	20.00	BFX89	1.00	JO2001	25.00
2N5847	19.90	40290 RCA	2.80	BFY11	2.50	JO4045	24.00
2N5849	20.00	40292 RCA	13.05	BFY18	2.50	KD5522	25.00
2N5913	3.25	40294 RCA	2.50	BFY19	2.50	KJ5522	25.00
2N5916	36.00	40341 RCA	21.00	BFY39	2.50	M1106	13.75

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M1107	$16.75	MRF458	$20.70	NE02160ER	$100.00	SD1009	$15.00
M1131	5.15	MRF464	25.30	NE021350	5.30	SD1009-2	15.00
M1132	7.25	MRF466	18.97	NE13783	61.00	SD1012	10.00
M1134	13.40	MRF472	1.50	NE21889	43.00	SD1012-3	10.00
M9116	29.10	MRF475	3.10	NE57835	5.70	SD1012-5	10.00
M9579	6.00	MRF476	3.16	NE64360ER-A	100.00	SD1013	10.00
M9580	7.95	MRF477	20.00	NE64480 (B)	94.00	SD1013-3	10.00
M9587	7.00	MRF479	8.05	NE73436	2.50	SD1013-7	10.00
M9588	5.20	MRF492	23.00	NE77362ER	100.00	SD1016	15.00
M9622	5.95	MRF502	1.04	NE98260ER	100.00	SD1016-5	15.00
M9623	7.95	MRF503	6.00	PRT8637	25.00	SD1018-4	13.00
M9624	9.95	MRF504	7.00	PT3127A	5.00	SD1018-6	13.00
M9625	15.95	MRF509	5.00	PT3127B	5.00	SD1018-7	13.00
M9630	14.00	MRF511	10.69	PT3127C	20.00	SD1018-15	13.00
M9740	27.90	MRF515	2.00	PT3127D	20.00	SD1020-5	10.00
M9741	27.90	MRF517	2.00	PT3127E	20.00	SD1028	15.00
M9755	16.00	MRF525	3.45	PT3190	20.00	SD1030	12.00
M9780	5.50	MRF559	1.76	PT3194	20.00	SD1030-2	12.00
M9827	11.00	MRF587	11.00	PT3195	20.00	SD1040	5.00
M9848	35.00	MRF605	20.00	PT3537	7.80	SD1040-2	20.00
M9850	13.50	MRF618	25.00	PT4166E	20.00	SD1040-4	10.00
M9851	20.00	MRF626	12.00	PT4176D	25.00	SD1040-6	5.00
M9860	8.25	MRF628	8.65	PT4186B	5.00	SD1043	12.00
M9887	2.80	MRF629	3.45	PT4209	25.00	SD1043-1	10.00
M9908	6.95	MRF641	25.30	PT4209C/5645	25.00	SD1045	3.75
M9965	12.00	MRF644	27.60	PT4556	24.60	SD1049-1	2.00
MM1500	25.00	MRF646	29.90	PT4570	7.50	SD1053	4.00
MM1550	10.00	MRF648	33.35	PT4577	20.00	SD1057	10.00
MM1552	50.00	MRF816	15.00	PT4590	5.00	SD1065	4.75
MM1553	50.00	MRF823	20.00	PT4612	20.00	SD1068	15.00
MM1607	8.45	MRF846	44.85	PT4628	20.00	SD1074-2	18.00
MM1614	10.00	MRF892	35.50	PT4640	20.00	SD1074-4	28.00
MM1810	15.00	MRF894	46.00	PT4642	20.00	SD1074-5	28.00
MM1810	15.00	MRF901 3 Lead	1.00	PT5632	4.70	SD1076	18.50
MM1943	1.80	MRF901 4 Lead	2.00	PT5749	25.00	SD1077	4.00
MM2608	5.00	MRF902/2N6603JAN	15.00	PT6612	25.00	SD1077-4	4.00
MM3375A	17.10	MRF902B	18.40	PT6619	20.00	SD1077-6	4.00
MM4429	10.00	MRF904	2.30	PT6708	25.00	SD1078-6	24.00
MM8000	1.15	MRF905	2.55	PT6709	25.00	SD1080-7	7.50
MM8006	2.30	MRF911	2.50	PT6720	25.00	SD1080-8	6.00
MM8011	25.00	MRF965	2.55	PT8510	15.00	SD1080-9	3.00
MPSU31	1.01	MRF966	3.55	PT8524	25.00	SD1084	8.00
MRA2023-1.5	42.50	MRF1000MA	32.77	PT8609	25.00	SD1087	15.00
MRF134	10.50	MRF1004M	31.05	PT8633	25.00	SD1088	22.00
MRF136	16.00	MRF2001	41.74	PT8639	25.00	SD1088-8	22.00
MRF171	35.00	MRF2005	54.97	PT8659	25.00	SD1089-5	15.00
MRF208	11.50	MRF5176	24.00	PT8679	25.00	SD1090	15.00
MRF212	16.10	MRF8004	2.10	PT8708	20.00	SD1094	15.00
MRF221	10.00	MSC1720-12	225.00	PT8709	20.00	SD1095	15.00
MRF223	13.00	MSC1821-3	125.00	PT8727	29.00	SD1098-1	30.00
MRF224	13.50	MSC1821-10	225.00	PT8731	25.00	SD1100	5.00
MRF227	3.45	MSC2001	30.00	PT8742	19.10	SD1109	18.00
MRF230	2.00	MSC2010	93.00	PT8787	25.00	SD1115-2	7.50
MRF231	10.00	MSC2223-10	245.00	PT8828	25.00	SD1115-3	7.50
MRF232	12.07	MSC2302	POR	PT9700	25.00	SD1115-7	2.10
MRF237	3.15	MSC3000	35.00	PT9702	25.00	SD1116	5.00
MRF238	13.80	MSC3001	38.00	PT9783	16.50	SD1118	22.00
MRF239	17.25	MSC72002	POR	PT9784	32.70	SD1119	5.00
MRF245	35.65	MSC73001	POR	PT9790	56.00	SD1124	50.00
MRF247	31.00	MSC80064	35.00	PT31083	20.00	SD1132-1	15.00
MRF304	36.00	MSC80091	10.00	PT31962	20.00	SD1132-4	12.00
MRF306	50.00	MSC80099	3.00	PTX6680	20.00	SD1133	9.50
MRF313	11.15	MSC80593	POR	RE3754	25.00	SD1133-1	10.00
MRF314	29.21	MSC80758	POR	RE3789	25.00	SD1134-1	2.50
MRF315	28.86	MSC82001	33.00	RF35	16.00	SD1134-4	12.00
MRF316	55.43	MSC82014	33.00	RF85	17.50	SD1134-17	12.00
MRF317	63.94	MSC82020M	130.00	RF110	21.00	SD1135	10.25
MRF412	18.00	MSC82030	33.00	S50-12	23.80	SD1135-3	12.00
MRF420	20.12	MSC83001	40.00	S3006	15.00	SD1136	12.50
MRF421	25.00	MSC83003	82.00	S3007	10.00	SD1136-2	12.50
MRF422	38.00	MSC83005	70.00	S3031	22.00	SD1143-1	10.00
MRF427	17.25	MSC83026	POR	SCA3522	5.00	SD1143-3	17.00
MRF428	63.00	MSC83303	POR	SCA3523	5.00	SD1144	4.00
MRF433	12.07	MSC84900	60.00	SD345	5.00	SD1145-5	15.00
MRF449/A	12.65	MT4150	14.40	SD445	5.00	SD1146	15.00
MRF450/A	14.37	MT5126	25.00	SD1004	15.00	SD1147	15.00
MRF452/A	17.00	MT5596(2N)	99.00	SD1007	15.00	SD1188	10.00
MRF453/A	18.40	MT5768(2N)	95.00	SD1007-2	15.00	SD1189	24.00
MRF454/A	20.12	MT8762	25.00	SD1007-4	15.00	SD1200	1.50
MRF455/A	16.00	NE02136	2.00	SD1007-5	15.00	SD1201-2	15.00

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MHz electronics

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RF Transistors (continued)

SD1202	$10.00	SD1304-8	$ 2.50	SD1451-2	$15.00	SRF1427	$50.00	SD1244H12	25.00	SD1410-8	21.00	SD1536-1	41.00	SRF2917	15.00
SD1212-8	4.95	SD1305	3.00	SD1452	20.00	SRF1431	40.00	SD1262	15.00	SD1413-1	18.00	SD1539H	100.00	SRF2918	15.00
SD1212-11	4.95	SD1307	3.00	SD1452-4	24.00	SRF1834	40.00	SD1263	15.00	SD1416	28.00	SD1542H1	170.00	SRF2919	15.00
SD1212-16	4.95	SD1308	3.00	SD1453H1	20.00	SRF2053-3	60.00	SD1263-1	15.00	SD1422-2	24.00	SD1544	26.00	SRF3071PF	50.00
SD1214-7	5.00	SD1311	1.00	SD1454-1	48.00	SRF2092	50.00	SD1272	10.95	SD1428	24.00	SD1545	33.00	SS4006	25.00
SD1214-11	5.00	SD1317	8.00	SD1477	35.00	SRF2147	22.00	SD1272-1	10.95	SD1428- 6084	12.00	SD1546H1	55.00	SS4152	15.00
SD1216	12.00	SD1319	2.50	SD1478	21.00	SRF2225	15.00	SD1272-2	10.95	SD1429-2	15.00	SD1561	79.00	TA7686	15.00
SD1219-4	15.00	SD1345-6	5.00	SD1480	53.00	SRF2264	25.00	SD1272-4	10.95	SD1429-3	14.90	SD1574-1	6.95	TA8559	15.00
SD1219-5	15.00	SD1347-1	1.00	SD1484	1.50	SRF2265	100.00	SD1278	13.75	SD1429-5	15.00	SD1575	6.95	TA8561	15.00
SD1219-8	15.00	SD1365-1	2.50	SD1484-5	1.50	SRF2281	5.00	SD1278-1	13.75	SD1430	12.00	SF4557	25.00	TA8562	15.00
SD1220	8.00	SD1365-5	2.50	SD1484-6	1.50	SRF2371	15.00	SD1278-5	13.75	SD1430-2	18.00	SK3048	5.00	TA8563	15.00
SD1220-1	9.50	SD1375	7.50	SD1484-7	1.50	SRF2347	50.00	SD1279-1	18.00	SD1434	28.00	SL501-59	15.00	TA8564	15.00
SD1220-9	8.00	SD1375-6	7.50	SD1488	22.85	SRF2356	38.00	SD1279-3	18.00	SD1434-5	28.00	SL501-173	15.00	TA8894	15.00
SD1222-8	16.00	SD1379	15.00	SD1488-1	28.00	SRF2378	16.00	SD1281-2	8.00	SD1434-9	28.00	SM7714	5.00	TIS189	3.55
SD1222-11	7.50	SD1380-1	1.00	SD1488-7	27.00	SRF2572	25.00	SD1283	10.00	SD1438	26.00	SRF112	15.00	TP312	2.50
SD1224-10	18.00	SD1380-3	1.00	SD1488-8	28.00	SRF2584	40.00	SD1283-2	10.60	SD1441	56.00	SRF395	50.00	TP1014	5.00
SD1225	18.00	SD1380-7	1.00	SD1499-1	36.00	SRF2597	25.00	SD1283-3	10.00	SD1442	15.00	SRF750	36.00	TP1028	15.00
SD1225-1	15.00	SD1405	21.00	SD1511H3	75.00	SRF2741	40.00	SD1283-4	10.00	SD1444	3.25	SRF769H	20.00	TRW3	5.00
SD1229-7	10.95	SD1408	25.00	SD1520-2	18.00	SRF2747	40.00	SD1289-1	15.00	SD1444-8	3.25	SRF887K3	2.50	TXVF2201/HP	450.00
SD1229-16	10.95	SD1409	18.00	SD1522-4	33.00	SRF2767M	40.00	SD1290-4	15.00	SD1444-9	3.25	SRF989K	15.00	V222-2	25.00
SD1232	4.00	SD1410	18.00	SD1528-1	24.00	SRF2821	25.00	SD1290-7	15.00	SD1446	4.03	SRF1005	50.00	V410IE	20.00
SD1240-8	15.00	SD1410-3	21.00	SD1528-3	34.00	SRF2822/2N6603	13.50	SD1300	1.25	SD1450-1	28.00	SRF1018	5.00	V415	5.00
SD1244-1	14.00	SD1410-6	21.00	SD1530-2	38.00	SRF2857	20.00	SD1301-7	3.00	SD1451	15.00	SRF1074	50.00		

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$7.99 or 2 For $13.99 or 10 For $50.00

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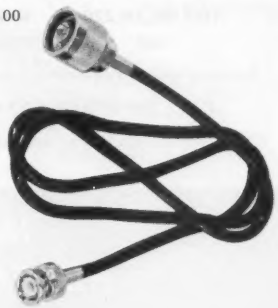

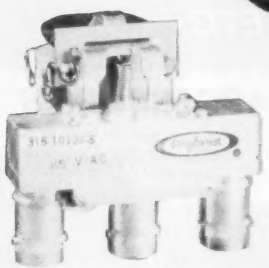

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C.O.D.' Acceptable by telephone or mail. Payment from customer will be by Cash, Money Order, or Cashier's Check. We are sorry but we cannot accept personal checks for C.O.D.'s. C.O.D.'s are shipped by air only and thru United Parcel Service.

CONFIRMING ORDERS: We would prefer that confirming orders not be sent after a telephone order has been placed. If company policy necessitates a confirming order, please mark "CONFIRMING" boldly on the order. If problems or duplicate shipments occur due to an order which is not properly marked, the customer will be held responsible for any charges incurred, plus a 15% restock charge on the returned parts.

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DATA SHEETS: When we have data sheets in stock on devices we will supply them with the order.

DEFECTIVE MATERIALS: All claims for defective materials must be made within 30 DAYS after receipt of the parcel. All claims must include the defective material (for testing purposes), a copy of our invoice, and a return authorization number which must be obtained prior to shipping the merchandise back to us. This can be obtained by calling (602) 242-8916 or sending us a postcard. Due to Manufacturer warranties we are unable to replace or issue credit on items which have been soldered to or have been altered in any way. All return items must be packed properly or it will void all warranties. We do not assume responsibility for shipping and handling charges incurred.

DELIVERY: Orders are usually shipped the same day they are placed or the next business day, unless we are out of stock on an item. The customer will be notified by post card if we are going to backorder the item. Our normal shipping method is UPS or U.S. Mail depending on size or the weight of the package. Test Equipment is shipped only by air and is freight collect, unless prior arrangements have been made and approved.

FOREIGN ORDERS: All foreign orders must be prepaid with a Cashier's Check, or Money Order made out in U.S. FUNDS ONLY. We are sorry but C.O.D. is not available to foreign countries and letters of credit are unacceptable as a form of payment. Further information is available on request.

HOURS: Monday thru Friday 8:30 a.m. to 5:00 p.m. Saturdays 8:30 a.m. to 4:00 p.m..

INSURANCE: Please include 25¢ for each additional $100.00 over $100.00, UPS ONLY. All insured packages are shipped thru UPS only. If you wish to have it shipped through the post office there is a $5.00 fee which is additional to the shipping, handling and insurance.

OPEN ACCOUNTS: We regret that we do not issue open accounts.

ORDER FORMS: New order forms are included with each order for your convenience. Additional order forms are available on request.

PARTS: We reserve the right to substitute or replace any item with a part of equal or comparable specification.

POSTAGE: Minimum shipping and handling in the U.S., Canada, and Mexico is $3.00 for ground shipments, all other countries is $5.50. Air rates are available at the time of your order. All foreign orders please include 25% of the ordered amount for shipping and handling. C.O.D.'s are shipped AIR ONLY.

PREPAID ORDERS: Orders must be accompanied by a check.

PRICES: Prices are subject to change without notice.

PURCHASE ORDERS: We accept purchase orders only when they are accompanied by a check.

RESTOCK CHARGES: If parts are returned to MHZ ELECTRONICS, INC. due to customer error, the customer will be held responsible for all fees incurred and will be charged a 15% RESTOCK CHARGE with the remainder in CREDIT ONLY. The following must accompany any return; A copy of our invoice, return authorization number which must be obtained prior to shipping the merchandise back. Returns must be done within 10 DAYS of receipt of parcel. Return authorization numbers can be obtained by calling (602) 242-8916 or notifying us by post card. Return authorizations will not be given out on our 800 number.

SALES TAX: ARIZONA residents must add 6% sales tax, unless a signed ARIZONA resale tax card is currently on file with us. All orders placed by persons outside of ARIZONA, but delivered to persons in ARIZONA are subject to the 6% sales tax.

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OUR 800 NUMBER IS STRICTLY FOR ORDERS ONLY (800) 528-0180. INFORMATION CALLS ARE TAKEN ON (602) 242-8916 or (602) 242-3037.

MHz electronics 48

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See List of Advertisers on page 80

THE MOST AFFORDABLE REPEATER

ALSO HAS THE MOST IMPRESSIVE PERFORMANCE FEATURES

(AND GIVES THEM TO YOU AS STANDARD EQUIPMENT!)

JUST LOOK AT THESE PRICES!

Band	Kit	Wired/Tested
10M,6M,2M,220	$680	$880
440	$780	$980

Both kit and wired units are complete with all parts, modules, hardware, and crystals.

CALL OR WRITE FOR COMPLETE DETAILS.

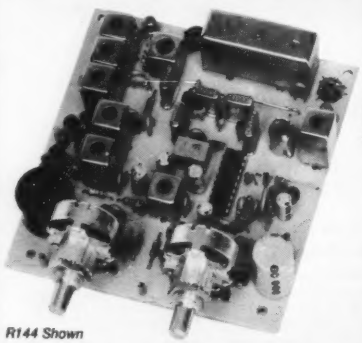
Also available for remote site linking, crossband, and remote base.

FEATURES:

- SENSITIVITY SECOND TO NONE; TYPICALLY 0.15 uV ON VHF, 0.3 uV ON UHF.
- SELECTIVITY THAT CAN'T BE BEAT! BOTH 8 POLE CRYSTAL FILTER & CERAMIC FILTER FOR GREATER THAN 100 dB AT ± 12KHZ. HELICAL RESONATOR FRONT ENDS. SEE R144, R220, AND R451 SPECS IN RECEIVER AD BELOW.
- OTHER GREAT RECEIVER FEATURES: FLUTTER-PROOF SQUELCH, AFC TO COMPENSATE FOR OFF-FREQ TRANSMITTERS, SEPARATE LOCAL SPEAKER AMPLIFIER & CONTROL.
- CLEAN, EASY TUNE TRANSMITTER; UP TO 20 WATTS OUT (UP TO 50W WITH OPTIONAL PA).

HIGH QUALITY MODULES FOR REPEATERS, LINKS, TELEMETRY, ETC.

HIGH-PERFORMANCE RECEIVER MODULES



R144 Shown

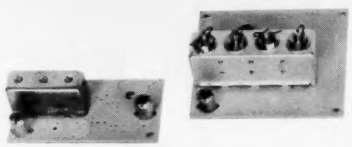
- **R144/R220 FM RCVRS** for 2M or 220 MHz. 0.15uV sens.; 8 pole xtal filter & ceramic filter in i-f, helical resonator front end for exceptional selectivity, more than −100 dB at ±12 kHz, best available today. Flutter-proof squelch. AFC tracks drifting xmtrs. Xtal oven avail. Kit only $138.
- **R451 FM RCVR** Same but for uhf. Tuned line front end, 0.3 uV sens. Kit only $138.
- **R76 FM RCVR** for 10M, 6M, 2M, 220, or commercial bands. As above, but w/o AFC or hel. res. Kits only $118.
  Also avail w/4 pole filter, only $98/kit.
- **R110 VHF AM RECEIVER** kit for VHF aircraft band or ham bands. Only $98.
- **R110-259 SPACE SHUTTLE RECEIVER,** kit only $98.

TRANSMITTERS

- **T51 VHF FM EXCITER** for 10M, 6M, 2M, 220 MHz or adjacent bands. 2 Watts continuous, up to 2½ W intermittent. $68/kit.

- **T451 UHF FM EXCITER** 2 to 3 Watts on 450 ham band or adjacent freq. Kit only $78.
- **VHF & UHF LINEAR AMPLIFIERS.** Use on either FM or SSB. Power levels from 10 to 45 Watts to go with exciters & xmtg converters. Several models. Kits from $78.
- **A16 RF TIGHT BOX** Deep drawn alum. case with tight cover and no seams. 7 x 8 x 2 inches. Designed especially for repeaters. $20.

ACCESSORIES



- **HELICAL RESONATOR FILTERS** available separately on pcb w/connectors.
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  HRF-220 for 213-233 MHz $38
  HRF-432 for 420-450 MHz $48
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- **DTMF DECODER/CONTROLLER KITS.** Control 2 separate on/off functions with touchtones®, e.g., repeater and autopatch. Use with main or aux. receiver or with Autopatch. Only $90
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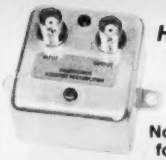
NEW LOW-NOISE PREAMPS



Hamtronics Breaks the Price Barrier!

*

No Need to Pay $80 to $125 for a GaAs FET Preamp.

FEATURES:

- Very Low Noise: 0.7 dB VHF, 0.8 dB UHF
- High Gain: 18 to 28 dB, Depending on Freq.
- Wide Dynamic Range for Overload Resistance
- Latest Dual-gate GaAs FET, Stable Over Wide Range of Conditions
- Rugged, Diode-protected Transistors
- Easy to Tune
- Operates on Standard 12 to 14 Vdc Supply
- Can be Tower Mounted

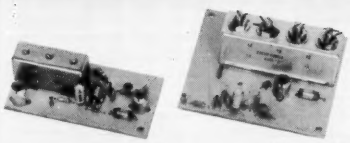
MODEL	TUNES RANGE	PRICE
LNG-28	26-30 MHz	$49
LNG-50	46-56 MHz	$49
LNG-144	137-150 MHz	$49
LNG-220	210-230 MHz	$49
LNG-432	400-470 MHz	$49
LNG-40	30-46 MHz	$64
LNG-160	150-172 MHz	$64

ECONOMY PREAMPS

Our traditional preamps, proven in years of service. Over 20,000 in use throughout the world. Tuneable over narrow range. Specify exact freq. band needed. Gain 16-20 dB. NF = 2 dB or less. VHF units available 27 to 300 MHz. UHF units available 300 to 650 MHz.

- P30K, VHF Kit less case $18
- P30W, VHF Wired/Tested $33
- P432K, UHF Kit less case $21
- P432W, UHF Wired/Tested $36

HELICAL RESONATOR PREAMPS



Our lab has developed a new line of low-noise receiver preamps with helical resonator filters built in. The combination of a low noise amplifier and the sharp selectivity of a 3 or 4 section helical resonator provides increased sensitivity while reducing intermod and cross-band interference in critical applications. See selectivity curves at right. Gain = approx.12 dB.

Model	Tuning Range	Price
HRA-144	143-150 MHz	$49
HRA-220	213-233 MHz	$49
HRA-432	420-450 MHz	$59
HRA-( )	150-174MHz	$69
HRA-( )	450-470 MHz	$79

RECEIVING CONVERTERS

Models to cover every practical rf & if range to listen to SSB, FM, ATV, etc. NF = 2 dB or less.

	Antenna Input Range	Receiver Output
VHF MODELS	28-32	144-148
	50-52	28-30
Kit with Case $49	50-54	144-148
Less Case $39	144-146	28-30
Wired $69	145-147	28-30
	144-144.4	27-27.4
	146-148	28-30
	144-148	50-54
	220-222	28-30
	220-224	144-148
	222-226	144-148
	220-224	50-54
	222-224	28-30
UHF MODELS	432-434	28-30
	435-437	28-30
Kit with Case $59	432-436	144-148
Less Case $49	432-436	50-54
Wired $75	439.25	61.25

SCANNER CONVERTERS Copy 72-76, 135-144, 240-270, 400-420, or 806-894 MHz bands on any scanner. Wired/tested Only $88.

SAVE A BUNDLE ON VHF FM TRANSCEIVERS!

FM-5 PC Board Kit – **ONLY $178**
complete with controls, heatsink, etc.
10 Watts, 5 Channels, for 2M or 220 MHz.

Cabinet Kit, complete with speaker, knobs, connectors, hardware. Only $60.

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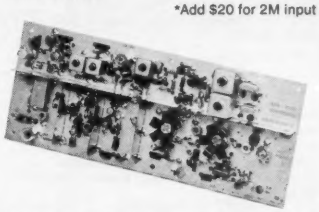
While supply lasts, get $60 cabinet kit free when you buy an FM-5 Transceiver kit. Where else can you get a complete transceiver for only $178

TRANSMIT CONVERTERS

For SSB, CW, ATV, FM, etc. Why pay big bucks for a multi mode rig for each band? Can be linked with receive converters for transceive. 2 Watts output vhf, 1 Watt uhf.

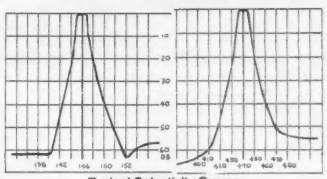
	Exciter Input Range	Antenna Output
For VHF,	28-30	144-146
Model XV2	28-29	145-146
Kit $79	28-30	50-52
Wired $149	27-27.4	144-144.4
(Specify band)	28-30	220-222*
	50-54	220-224
	144-146	50-52
	50-54	144-148
	144-146	28-30
For UHF,	28-30	432-434
Model XV4	28-30	435-437
Kit $99	50-54	432-436
Wired $169	61.25	439.25
	144-148	432-436*

*Add $20 for 2M input



VHF & UHF LINEAR AMPLIFIERS. Use with above. Power levels from 10 to 45 Watts. Several models, kits from $78.

LOOK AT THESE ATTRACTIVE CURVES!



Typical Selectivity Curves of Receivers and Helical Resonators.

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The biggest and best ham store in the Midwest featuring Kenwood and other quality products with working displays. We sell only the best. Authorized Kenwood service. **Universal Amateur Radio, Inc., 1280 Aida Dr., Reynoldsburg (Columbus) OH 43068, 866-4267.**

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IBM PC/XT kits, supplies, expansion products; video restorer kits for pay TV, CATV, satellite hobbyists' electronic project kits/appnotes. More than 9000 parts in stock: semiconductors, ICs, discretes, video accessories, tools, audio, automotive, cabinets, computer peripherals. Please write for your free 60-page catalog: **Sabet Electronics, 13650 Floyd Rd., Ste. 104, Dallas TX 75243; 783-4950 (formerly I.E.).**

DEALERS

Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the March '85 issue must be in our hands by January 1st. Mail to 73 Magazine, Peterborough, NH 03458. ATTN: Nancy Ciampa.

PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15						20	20A	15			
ARGENTINA	20										15	15
AUSTRALIA	20					40	40			20	20	15
CANAL ZONE	40	40					20	15	15	15	15	20
ENGLAND	40	40	40	80	80		20	15	15	15	20	
HAWAII	20					40	20	20			15	15
INDIA							20	20				
JAPAN	15						20	20				15
MEXICO	40	40	40	40	40	40	20	15	15	15	15	20
PHILIPPINES							20	20				
PUERTO RICO	40	40	40	40	40	40	20	15	15	15	15	20
SOUTH AFRICA	40A	40						15	15	20		
U. S. S. R.		40						15	15	20		
WEST COAST	15	20	40	40	40	40	40A	20A	15	15	15	15

CENTRAL UNITED STATES TO:

ALASKA	20				40	40	20	20				20
ARGENTINA	20	40	40	40						15	15	20A
AUSTRALIA	15					40	20	20	20		15	15
CANAL ZONE	20		40	40	40			20	15	15	15	15
ENGLAND	40	40	80	80				15	15	15	20	
HAWAII	20	20			40	40	20	20	20	15	15A	15A
INDIA								20				
JAPAN	20				40	40	20	20				20
MEXICO	20		40	40	40			20	15	15	15	15
PHILIPPINES	20							20	20			
PUERTO RICO	20		40	40	40			20	15	15	15	15
SOUTH AFRICA	20	40	40						15	15	15	20
U. S. S. R.		40	40					15	15	20		

WESTERN UNITED STATES TO:

ALASKA	15	15	20			40	40	40				20
ARGENTINA	20	20		40	40						15	15
AUSTRALIA	15	15	20				40		20	20	20	15
CANAL ZONE	20	20		40	40	40	40	40	15	15	15	15
ENGLAND			40	40					20A	20A		
HAWAII	15	20	20			40	40	40				15
INDIA		20	20									
JAPAN	15	15	20				40	40	40			20
MEXICO	20	20		40	40	40	40	40				15
PHILIPPINES	20A	20								20		
PUERTO RICO	20	20		40	40	40	40	40				15
SOUTH AFRICA	20	20							15	15	15	20
U. S. S. R.								20	20	20	20	
EAST COAST	15	20	40	40	40	40	20	20A	15	15	15	15

A = Next higher frequency may also be useful.
B = Difficult circuit this period.

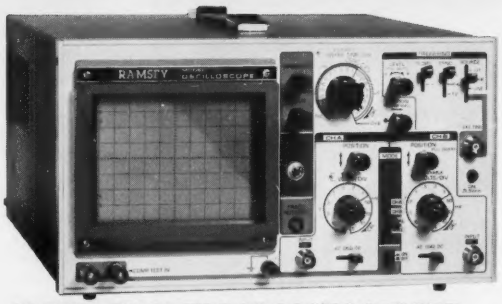
G = Good, F = Fair, P = Poor.

DECEMBER

SUN	MON	TUE	WED	THU	FRI	SAT
						1 G
2 G	3 G	4 F	5 P	6 F	7 G	8 G
9 F	10 G	11 G	12 G	13 F	14 F-P	15 P
16 F	17 G	18 G-F	19 F-P	20 P	21 P	22 F
23 G 30 F	24 G 31 F-G	25 F	26 G	27 G	28 G	29 G-F

RAMSEY

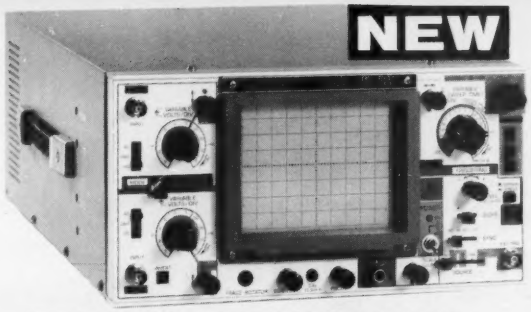
THE FIRST NAME IN ELECTRONIC TEST GEAR



20 MHz DUAL TRACE OSCILLOSCOPE

Unsurpassed quality at an unbeatable price, the Ramsey oscilloscope compares to others costing hundreds more. Features include a component testing circuit for resistor, capacitor, digital circuit and diode testing. • TV video sync filter • wide bandwidth & high sensitivity • internal graticule • front panel trace rotator • Z axis • high sensitivity x-y mode • regulated power supply • built-in calibrator • rock solid triggering * **USA—Add $10.00 per unit for postage, overseas orders add 15% of total order for Insured Surface Mail**

$399.95* high quality hook on probes included



NEW

45 MHz DUAL SWEEP OSCILLOSCOPE

The Ramsey 625 is a dual time base, delayed sweep unit that includes a built-in signal delay line to permit clear viewing during very short rise times of high frequency waveforms. Other features include: variable trigger holdoff • 20 calibrated sweep time ranges from 0.5 s/div to 0.2 µS/div. • fully adjustable sweep time • X5 sweep magnification • five trigger sources: CH1, CH2, LINE EXTernal and INTernal (V mode) • front panel x-y operation, Z axis input • sum difference of CH1, and CH2 waveforms displayed as single trace • sweep gate and sweep output • auto focus • single sweep * **USA—Add $10.00 per unit for postage, overseas orders add 15% of total order for Insured Surface Mail.**

$799.95* high quality hook on probes included

RAMSEY D-1100 VOM MULTITESTER

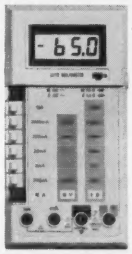
Compact and reliable, designed to service a wide variety of equipment. Features include • mirror back scale • double-jeweled precision moving coil • double overload protection • an ideal low cost unit for the beginner or as a spare back-up unit.

$19.95 test leads and battery included

NEW RAMSEY 1200 VOM MULTITESTER

Check transistors, diodes and LEDs with this professional quality meter. Other features include: decibel scale • 20K volt metering system • 3½" mirrored scale • polarity switch • 20 measuring ranges • safety probes • high impact plastic case

$24.95 test leads and battery included



RAMSEY D-3100 DIGITAL MULTIMETER

Reliable, accurate digital measurements at an amazingly low cost • in-line color coded push buttons, speeds range selection • abs plastic tilt stand • recessed input jacks • overload protection on all ranges • 3½ digit LCD display with auto zero, auto polarity & low BAT. indicator

$49.95 test leads and battery included

CT-70 7 DIGIT 525 MHz COUNTER

Lab quality at a breakthrough price. Features • 3 frequency ranges each with pre amp • dual selectable gate times • gate activity indicator • 50mV @ 150 MHz typical sensitivity • wide frequency range • 1 ppm accuracy

$119.95 wired includes AC adapter

CT-70 kit $99.95
BP-4 nicad pack 8.95

CT-90 9 DIGIT 600 MHz COUNTER

The most versatile for less than $300. Features 3 selectable gate times • 9 digits • gate indicator • display hold • 25mV @ 150 MHz typical sensitivity • 10 MHz timebase for WWV calibration • 1 ppm accuracy

$149.95 wired includes AC adapter

CT-90 kit $129.95
OV-1 0.1 PPM oven timebase 59.95
BP-4 nicad pack 8.95

CT-125 9 DIGIT 1.2 GHz COUNTER

A 9 digit counter that will outperform units costing hundreds more. • gate indicator • 24mV @ 150 MHz typical sensitivity • 9 digit display • 1 ppm accuracy • display hold • dual inputs with preamps

$169.95 wired includes AC adapter

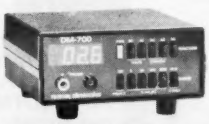
BP-4 nicad pack 8.95

CT-50 8 DIGIT 600 MHz COUNTER

A versatile lab bench counter with optional receive frequency adapter, which turns the CT-50 into a digital readout for most any receiver • 25 mV @ 150 MHz typical sensitivity • 8 digit display • 1 ppm accuracy

$169.95 wired

CT-50 kit $139.95
RA-1 receiver adapter kit 14.95



DM-700 DIGITAL MULTIMETER

Professional quality at a hobbyist price. Features include 26 different ranges and 5 functions • 3½ digit, ½ inch LED display • automatic decimal placement • automatic polarity

$119.95 wired includes AC adapter

DM-700 kit $99.95
MP-1 probe set 4.95

PS-2 AUDIO MULTIPLIER

The PS-2 is handy for high resolution audio resolution measurements, multiplies UP in frequency • great for PL tone measurements • multiplies by 10 or 100 • 0.01 Hz resolution & built-in signal preamp/conditioner

$49.95 wired

PS-2 kit $39.95

PR-2 COUNTER PREAMP

The PR-2 is ideal for measuring weak signals from 10 to 1,000 MHz • flat 25 db gain • BNC connectors • great for shifting RF • ideal receiver/TV preamp

$44.95 wired includes AC adapter

PR-2 kit $34.95

PS-1B 600 MHz PRESCALER

Extends the range of your present counter to 600 MHz • 2 stage preamp • divide by 10 circuitry • sensitivity: 25mV @ 150 MHz • BNC connectors • drives any counter

$59.95 wired includes AC adapter

PS-1B kit $49.95

ACCESSORIES FOR RAMSEY COUNTERS

Telescopic whip antenna—BNC plug	$ 8.95
High impedance probe, light loading	16.95
Low pass probe, audio use	16.95
Direct probe, general purpose use	13.95
Tilt bail, for CT-70, 90, 125	3.95

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PHONE ORDERS CALL
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TERMS: • satisfaction guaranteed • examine for 10 days; if not pleased, return in original form for refund • add 6% for shipping and insurance to a maximum of $10.00 • overseas add 15% for surface mail • COD add $2.50 (COD in USA only) • orders under $15.00 add $1.50 • NY residents add 7% sales tax • 90 day parts warranty on all kits • 1 year parts & labor warranty on all wired units.

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With SMART PATCH You are in CONTROL

With CES 510SA Simplex Autopatch, there's no waiting for VOX circuits to drop. Simply key your transmitter to take control.

SMART PATCH is all you need to turn your base station into a personal autopatch. SMART PATCH uses the only operating system that gives the mobile complete control. Full break-in capability allows the mobile user to actually interrupt the telephone party. SMART PATCH does not interfere with the normal use of your base station. SMART PATCH works well with any FM transceiver and provides switch selectable tone or rotary dialing, toll restrict, programmable control codes, CW ID and much more.

To Take CONTROL with Smart Patch – Call 800-327-9956 Ext. 101 today.

What To Look For In A Phone Patch

The best way to decide what patch is right for you is to first decide what a patch should do. A patch should:

- Give complete control to the mobile, allowing full break in operation.
- Not interfere with the normal operation of your base station. It should not require you to connect and disconnect cables (or flip switches!) every time you wish to use your radio as a normal base station.
- Not depend on volume or squelch settings of your radio. It should work the same regardless of what you do with these controls.
- You should be able to hear your base station speaker with the patch installed. Remember, you have a base station because there are mobiles. ONE OF THEM MIGHT NEED HELP.
- The patch should have standard features at no extra cost. These should include programmable toll restrict (dip switches), tone or rotary dialing, programmable patch and activity timers, and front panel indicators of channel and patch status.

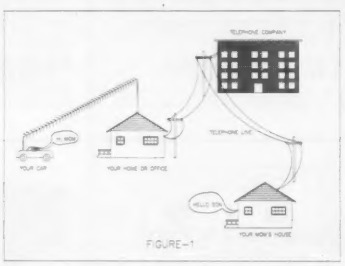
ONLY SMART PATCH HAS ALL OF THE ABOVE.

Now Mobile Operators Can Enjoy An Affordable Personal Phone Patch. . .

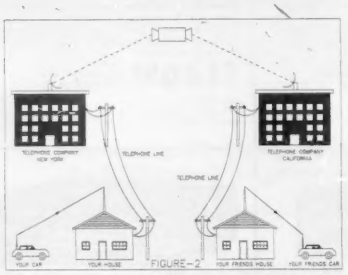
- Without an expensive repeater.
- Using any FM tranceiver as a base station.
- The secret is a SIMPLEX autopatch, The *SMART PATCH.*

SMART PATCH Is Easy To Install

To install *SMART PATCH*, connect the multicolored computer style ribbon cable to mic audio, receiver discriminator, PTT, and power. A modular phone cord is provided for connection to your phone system. Sound simple? . . . IT IS!



FIGURE–1



FIGURE–2

How To Use *SMART PATCH*

Placing a call is simple. Send your access code from your mobile (example: *73). This brings up the Patch and you will hear dial tone transmitted from your base station. Since *SMART PATCH* is checking about once per second to see if you want to dial, all you have to do is key your transmitter, then dial the phone number. You will now hear the phone ring and someone answer. Since the enhanced control system of *SMART PATCH* is constantly checking to see if you wish to talk, you need to simply key your transmitter and then talk. That's right, you simply key your transmitter to interrupt the phone line. The base station automatically stops transmitting after you key your mic. *SMART PATCH* does not require any special tone equipment to control your base station. It samples very high frequency noise present at your receivers discriminator to determine if a mobile is present. No words or syllables are ever lost.

SMART PATCH Is All You Need To Automatically Patch Your Base Station To Your Phone Line.

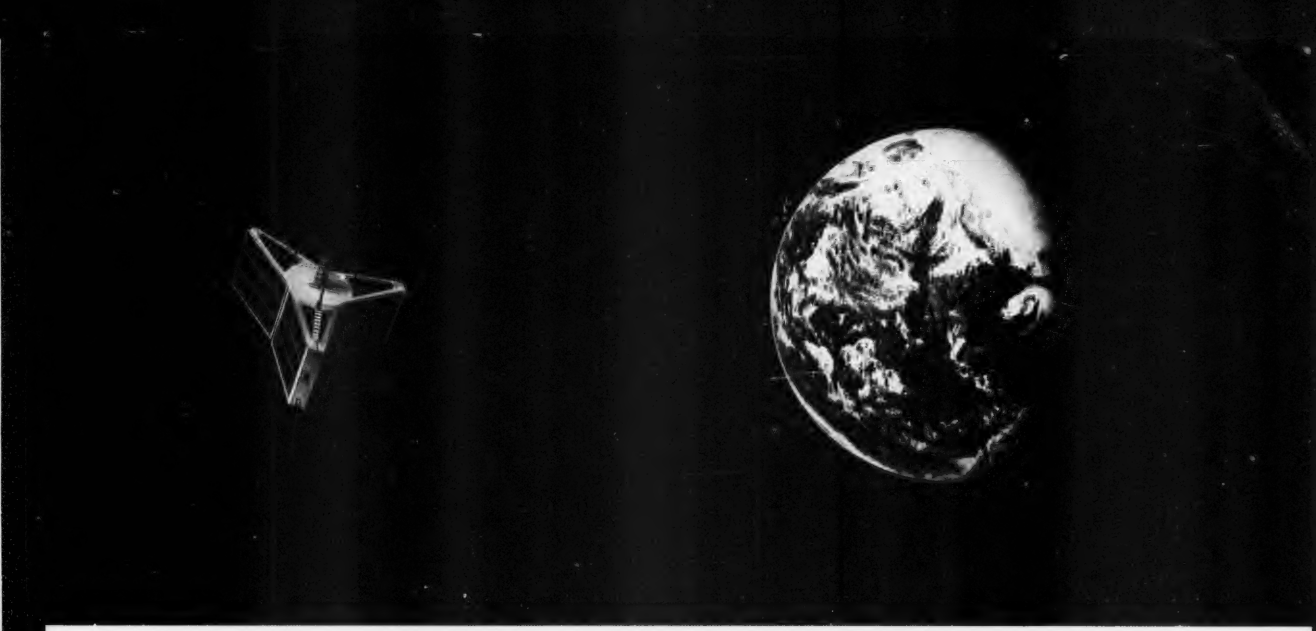
Use *SMART PATCH* for:

- Mobile (or remote base) to phone line via Simplex base. (see fig 1.)
- Mobile to Mobile via interconnected base stations for extended range. (see fig. 2.)
- Telephone line to mobile (or remote base).
- *SMART PATCH* uses SIMPLEX BASE STATION EQUIPMENT. Use your ordinary base station. *SMART PATCH* does this without interfering with the normal use of your radio.

WARRANTY?
YES, 180 days of warranty protection. You simply can't go wrong.
An FCC type accepted coupler is available for *SMART PATCH.*

CES® ✓462

Communications Electronics Specialties, Inc.
P.O. Box 2930, Winter Park, Florida 32790
Telephone: (305) 645-0474 **Or call toll-free (800)327-9956**



The DX is better out here. Ask anyone who owns an FT-726R.

It's true. Linking up to OSCAR 10 is the one sure way to bring the world into your ham shack. No matter where your shack is.

FT-726R owners know. You'll find them working the world from their apartments. Attics. And from their antenna-restricted neighborhoods.

They'll even boast of a signal quality and DX potential that would make any 20-meter operator envious. Regardless of where we are in the sunspot cycle.

In fact, the FT-726R is the world's most popular link to OSCAR 10.

And for good reason. This 2-meter, 10-watt rig gives you full cross-band duplex capability. Simply plug in two optional modules, one for 435-MHz operation, another for cross-band duplex.

You can set up your earth station just about anywhere. All you need is the 726 and two Yagi antennas: 435-MHz for transmit and 2-meters for receive.

Even as a conventional base station, the FT-726R is a real standout.

You can choose from three operating modes: SSB, FM or CW. Expand to three-band operation with your choice of optional modules for 10 meters, 6 meters, 430-440 MHz and 440-450 MHz.

Then store your preferred frequencies and modes into the eleven memories for instant recall. With pushbutton transfer capability to either of two VFO registers. And versatile scanning functions you'd expect from a Yaesu radio.

Plus you get a lot more extras, including a built-in speech processor, all-mode squelch and a noise blanker.

So no matter where your shack is, let Yaesu's FT-726R introduce you to OSCAR 10. The world is waiting.

YAESU

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6851 Walthall Way, Paramount, CA 90723
(213) 633-4007

Yaesu Cincinnati Service Center
9070 Gold Park Drive, Hamilton, OH 45011
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TS-430S "Digital DX-terity!"

TS-430S

Digital DX-terity... that outstanding attribute built into every KENWOOD TS-430S that lets you QSY from band to band, frequency to frequency, and from mode to mode with the speed and ease that will give you a dominant position in DX operations.

KENWOOD'S TS-430S, a revolutionary, ultra-compact, HF transceiver has already won the hearts of radio Amateurs the world over. It covers 160-10 meters, including the new WARC bands (easily modified for HF MARS). Its high dynamic range receiver tunes from 150 kHz-30 MHz. It utilizes an innovative UP conversion PLL circuit for superior frequency stability and accuracy. Two digital VFO's allow fast split-frequency operations. A choice of USB, LSB, CW, or AM, with FM optional, are at the operators fingertips. All Solid-state technology permits inputs of 250 watts PEP on SSB, 200 watts DC on CW, 120 watts on FM (optional), or 60 watts on AM. Final amplifier protection circuits and a cooling fan are built-in.

Eight memories store frequency, mode, and band data, with Lithium battery memory back-up. Memory scan and programmable automatic band scan help speed up operations. An IF shift circuit, a tuneable notch filter, and a Narrow-Wide switch for IF filter selection help eliminate QRM. It has a built-in speech processor. A fluorescent tube digital display makes tuning easy and fast. An all-mode squelch circuit, a noise blanker, and an RF attenuator control help clean up the signal. And there's a VOX circuit, plus semi-break-in, with side-tone. All-in-all, it just could be that the expression "Digital DX-terity" is a bit of an understatement.

TS-430S Optional Accessories: In typical KENWOOD fashion, there are plenty of optional accessories for this great HF transceiver. There is a special power supply, the PS-430. An external speaker, the SP-430, is also available. And the MB-430 mounting bracket is available for mobile operation. The AT-250 automatic antenna tuner was designed primarily with the TS-430S in mind, and for those who prefer to "roll their own" the AT-130 antenna tuner is available. The FM-430 FM unit is available for FM operations. The YK-88C (500 Hz) or YK-88CN (270 Hz) CW filters, the YK-88SN SSB filter, and the YK-88A AM filter may be easily installed for serious DX-ing. An MC-60A deluxe desk microphone, MC-80 and MC-85 communications microphones, an MC-42S mobile hand mic., and an MC-55 8-pin mobile microphone, are available, depending on your requirements. TL-922A linear amplifier (not for CW QSK), SM-220 station monitor, PC-1A phone patch, SW-2000 SWR/power meter 160~6 meter, SW100A SWR/power/volt meter 160-2m, HS-4, HS-5, HS-6, HS-7 headphones, are also available.

More information on the TS-430S is available from authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, California 90220.

Specifications and prices are subject to change without notice or obligation.